Geochronology Pilot Study
Floodplain Soils, Tittabawassee River, Michigan

FINAL

Prepared for:

The Dow Chemical Company

May 2005

Limno-Tech, Inc.

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1. INTRODUCTION

Soils in the floodplain adjacent to the Tittabawassee River have been found to contain dioxins and furans at varying levels under preliminary sampling conducted by the Michigan DEQ (MDEQ, 2002). The role of the floodplain in the redistribution and/or burial of existing contaminants within the floodplain soil and the potential exchange of contaminants with the river during floods is currently unknown. However, understanding the movement of soil within the floodplain and the potential role of sediments and floodplain soils as an ongoing source of solids loading during flood events is an important element of the overall understanding of solids transport in the river-floodplain system.

This report describes the results of the geochronologic pilot study of cesium-137 and lead-210 in soils in the floodplains adjacent to the Tittabawassee River. The study represents a preliminary geochronologic coring effort initiated in the spring of 2004 to measure historical soil deposition patterns. The goal of this report is to test whether the method can be successfully applied under conditions in the Tittabawassee River floodplain and to document existing conditions in the floodplain. This preliminary data assessment also serves to identify data problems and sources of variability, error and potential confounding factors in future floodplain studies.

The remainder of this report is divided into four sections. Section 2 gives background information necessary to understand geochronologic methods, Section 3 describes the specific design elements for the geochronologic soil accretion rate study, Section 4 presents preliminary results, and conclusions and recommendations are given in Section 5.

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2. BACKGROUND ON GEOCHRONOLOGIC METHODS

2.1. Rationale of Radionuclide-Based Soil Accretion Rate Estimates

Cesium-137 and lead-210 have been widely used to age-date soils and sediments and to establish long-term accumulation rates. Example studies have been conducted in coastal environments (Saad and Al-Azmi, 2002), river floodplain soils (van der Perk et al., 2002; Du et al, 1998; Rowan and Walling, 1992; Golosov et al., 1999; Borghuis et al., 2002; He and Walling, 2000; Winkelmann et al, 1998; Garten et al., 1978), in river sediments (Jha et al., 2003; Huntley et al., 1995), floodplain-lake sediments (Winter et al., 2001), cultivated and grazed soils (Du et al., 1998; Golosov et al., 1999; He and Walling, 2000;), with soil types spanning the entire spectrum, from clayey and peaty (van der Perk et al., 2002; Rowan and Walling, 1992; Winkelmann et al., 1998) to loose and sandy (Saad and Al-Azmi, 2002). Sample density ranged from a few representative samples (Du et al., 1998), to samples in scattered locations (Du et al., 1998; Saad and Al-Azmi, 2002), to tens of samples in floodplain and river transects (Borghuis et al., 2002), to greater than 100 gridded samples (van der Perk et al., 2002; Rowan and Walling, 1992).

Examination of radionuclide inventories and observations of spatial patterns and trends have been used to infer erosion and deposition rates (van der Perk et al., 2002; Du et al., 1998), patterns of fluvial redistribution of floodplain soils (van der Perk et al., 2002; Du et al., 1998; Rowan and Walling, 1992), factors responsible for observed differences in spatial variability patterns (van der Perk et al., 2002; Golosov et al., 1999; Martynenko et al., 2003), vertical cesium patterns as a function of land-use and soil types (Du et al., 1998), uncertainty in inventory and rate calculations (Borghuis et al., 2002), and transport of sediment and contaminants within floodplains and rivers and into lakes (Winter et al., 2001).

The fact that the radionuclides cesium-137 and lead-210 readily and strongly attach to clay and organic particles allows soil and sediment accretion rates to be estimated from activity levels of these two elements. Activity is a measure of concentration related to the radioactivity of the two substances and is measured in units of pico-curies per second or decays per minute. Cesium-137 desorbs more readily from soil particles and is most mobile in sandy soils with low clay and/or organic content, therefore, in some environments, cesium-derived sedimentation rates are associated with a greater level of uncertainty (Huntley et al., 1995; Du et al., 1998; Rowan and Walling 1992).

Lead-210 is a decay product of radon-222 and is present in soils and sediments primarily as a result of recent atmospheric deposition. Radon-222 is a volatile, short-lived intermediate daughter product of uranium-238 decay, a naturally occurring radioisotope found in the earth's crust. Lead-210 is deposited on the earth's surface at a relatively constant rate related to the volatilization rate of radon-222. Once deposited, the activity of lead-210 decreases exponentially with time, with a decay half life of 22 years. This portion of lead-210 is defined as "unsupported lead-210." The only other source of lead-210 is decay of radium-226 (an element similar only in name to radon-222) within the soil/sediment column itself. This portion of lead-210, termed "supported lead-210," must be accounted for (subtracted) when age-dating sediments using lead-210 (Huntley et al., 1995).

Cesium-137 is a man-made isotope produced only during nuclear fission. Cesium-137 first entered the atmosphere during atmospheric testing of nuclear weapons, which began in 1954 and peaked in 1963-1964. Like lead-210, cesium-137 enters the soil/sediment through atmospheric deposition. The depth interval containing sediments deposited in 1954 can be identified because cesium-137 was not present in the natural environment prior to that time. The peak of the cesium-137 soil profile is usually identified in sediments deposited around 1963. Most often, the cesium-137 horizon of 1954 is used as the benchmark depth against which soil and sediment accumulation rates are estimated. These calculations rely on the assumption that the deposition rate has been mostly constant over time (Huntley et al., 1995).

2.2. Sources of Uncertainty and Method Limitations

The assumption of constant depositional rate of cesium-137 may not hold true. However, the assumption of constant deposition can be evaluated using measurements of lead-210. A high correlation between the activities of the two radionuclides indicates greater confidence that cesium-based accretion rates are accurate (Huntley et al., 1995).

Another source of uncertainty derives from the determination of background activity in the soil/sediment column. Measured activity is never truly zero, rather, after a certain depth, activity fluctuates randomly around a very low level (background). The depth at which background activity levels are reached is a necessary input in models used to estimate the accretion rate. For cesium-137, it helps establish the likely depth of the 1954 horizon, and for lead-210, it helps determine the supported fraction of activity. This implies that cores must be deep enough to reach background activity, and at least 3 samples are necessary from the deeper sections to establish its value (Flett, 2005).

Uncertainty is also introduced by the nature of the sedimentary environment. The greater the sediment/soil deposition rate, the greater the extent of dilution of the radionuclides attached to the particle surfaces. At high accretion rates, radionuclide concentrations can be so diluted that measured values can be difficult to distinguish from background. In such cases, sedimentation rates can be difficult or impossible to estimate with radionuclides alone and are generally used in conjuntion with other methods, such as dendrogeochronology. Estimates are also highly uncertain when mixing processes in soils/sediments (e.g. due to erosion/redeposition, bioturbation by worms, moles and other aquatic and terrestrial organisms) alter the initially deposited sediment profile (Flett, 2005; Huntley et al., 1995).

2.3. Calculation of Sedimentation Rates

The local accretion rate based on cesium is calculated simply as the ratio of the thickness of the soil column above the 1954 horizon and the elapsed number of years since 1954 up to the year of sampling.

For lead-210, calculation of accretion rate is more complex, since several factors must enter the calculation: the lead-210 decay constant, the supported activity and the unsupported activity.

Two different models based on different sets of assumptions can be used to estimate sedimentation rates from lead-210, depending on which set of assumptions hold for a given core. In some circumstances, assumptions of both models can be met, and using two models gives a more robust estimate of sedimentation rate. The constant initial concentration model (CIC) assumes a constant initial concentration of unsupported lead-210 and a constant sedimentation rate over the period of time for which the unsupported lead-210 is measurable. The method requires either measurements of sediment porosity to correct for compaction, or cumulative dry weight. The constant rate of supply of unsupported lead-210 model (CRS) assumes a constant supply of lead-210, but it can consider variable sedimentation rate and sediment compaction. Both models assume constant flux of unsupported lead-210 to the sediment-water interface over time. The CRS model requires a core that is long enough to include all of the measurable atmospheric source lead-210 (i.e. background present at depth) (Turner and Delorme, 1996).

With the CIC model sedimentation rates are calculated by solving an equation that balances the total activity of lead-210, A_{tx}, at a given depth x and time t (e.g. a given core segment) against the sum of the radioactive decay of unsupported lead-210 and supported lead-210, A', leading to an equation that can be solved graphically:

$$\ln(A_{tx}-A') = \ln(P/\omega)-(\lambda/S_0)x,$$

where P is the flux of lead-210 at the sediment-water interface in pico-curies per square centimeter per year, ω is the mass sedimentation rate in grams per square centimeter per year, λ is the radioactive decay constant for lead-210 (0.0311/yr) and S_0 is the sedimentation rate in centimeters per year at the sediment-water interface. Graphically, λ/S_0 is the slope of the line plotting x vs. $\ln(A_{tx}-A')$. S_0 is calculated from the slope and the known decay constant. The time t in years since the sample was deposited is given by x/S_0 (Turner and Delorme, 1996).

In the CRS model, the age of a given layer of sediment or soil is calculated from the cumulative unsupported lead-210 *beneath* sediments of a depth x (i.e. background), $B(x)$, and from the total residual unsupported lead-210 in the entire sediment column, $B(0)$. The time is given by

$$t = -(1/\lambda)\cdot\ln[B(x)/B(0)],$$

and $B(x)$ and $B(0)$ are calculated by direct numerical integration of the lead-210 profile (plot of unsupported activity versus cumulative dry weight) (Turner and Delorme, 1996).

3. PROCEDURES AND STUDY DESIGN

This study design was modeled on previous investigations on various floodplains throughout the country where geochronology (in combination with other methods) was successfully used to provide insight into soil/sediment exchange between a river and its floodplain and soil transport within the floodplain (e.g., WRP Technical Note SD-CP-4.1, 1993; Steiger *et al*., 2003; Shroder, 1980; Phipps, *et al*., 1995; Hupp and Morris, 1990; Hupp and Bazemore, 1993; and Heimann and Roell, 2000). In these studies, sampling locations were distributed throughout the floodplain (e.g., Heimann and Roell, 2000), on a regular grid or in transects (Kleiss, 1996), and study length ranged from a single event to 4 years.

This preliminary study utilized measurements of cesium-137 and lead-210 to evaluate long-term depositional rates on the floodplain. The approach selected for this study was to collect soil cores along predefined transects along the Tittabawassee River floodplain downstream of the Dow Midland Plant. Cores were collected from the surface down to the water table and were segmented in smaller intervals to estimate radionuclide activity at various depths and help establish the minimum necessary depth of future cores.

The coring took place in the fall of 2004 at the following three study sites:

1. Dow property near Rockwell Drive (5 cores)
2. Imerman Park (5 cores)
3. Dow Property near Caldwell Boat Launch (5 cores)

Core locations were identified with GPS equipment. The coring locations on the transects are coordinated with other study design elements to allow for comparisons (dendrogeomorphic and clay pad studies).

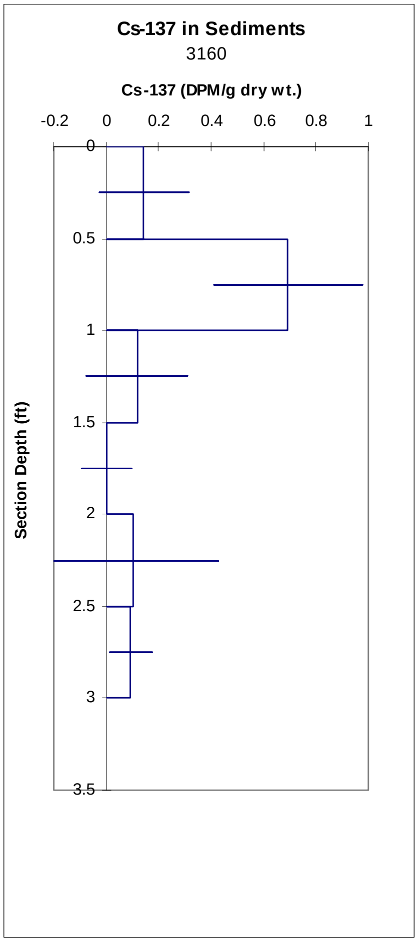
The cores were extracted with a geoprobe using direct push techniques. The cores penetrated deep enough to reach the groundwater table (between 2 and 11 ft). The Lexan tubes containing the cores were sealed with Teflon® caps and Teflon® tape, the core sections were labeled and were put in a cooler with ice in a vertical position. When possible, geochronologic cores are generally sectioned into thin 0.5-2 inch intervals. In this study, field procedures called for 1-inch sections, but conditions (sandy and wet soil column) resulted in incomplete recovery and significant compaction of the cores. Core recovery was variable across the study area and within each sample location (3 cores were required for each location). Generally core recovery was near 60% for most cores. The low recovery combined with the inconsistent recovery rates within sample locations precluded high vertical resolution due to the uncertainty in assigning each sample to a specific depth. To account for the uncertainty in vertical position of individual samples, the decision was made to analyze the cores in 0.5 foot intervals. The cores were sliced into 0.5 foot intervals in the laboratory (except section 11 in core MSE-03151, which was only 0.17 ft for unspecified reasons, but that did not compromise dating results).

4. RESULTS

The following sections present results of the radionuclide measurements performed by Flett Research, Ltd. Raw data are included in Appendix A.

In each core, between 4 and 17 consecutive 0.5 foot segments were analyzed for cesium-137 and lead-210. The activity of each radionuclide was quantified along with the laboratory/equipment specific uncertainty for that soil segment. A given measurement was considered above background if its error bar did not significantly overlap with the error bars on activities of deeper segments. Cesium-137 was found only in the top 0.5 ft of sediment in 9 of the 15 sample locations. This means that the upper 0.5 ft or less was deposited after 1954 and the sedimentation rate cannot be further refined without the collection of smaller sample intervals. Only one core had significant amounts of cesium-137 in the 0.5 to 1 ft interval (THT-03160 in Imerman Park, Figure 1.). In the remaining cores the presence of some cesium-137 in the 0.5 to 1 ft interval is possible based on background levels, but the results were inconclusive. Thus, each core has a cesium-137 derived *upper bound estimate* on soil accretion rates ranging from 0.12 or less to 0.26 inches per year.

Lead-210 provided estimates of soil accretion rates in only 5 out of the 15 core locations (each of the three study areas had at least one core with an interpretable lead-210 profile, see Figure 2 for example profile at core FRE-3158). The remaining cores had lead-210 measurements at background levels or had vertical or erratic profiles, which could not be interpreted. Such profiles could be due to very high deposition rates and associated dilution of sorbed radionuclides and/or to the action of mixing processes over the time period of deposition. Lead-210-based estimates of soil accretion rates ranged from 0.11 to 0.31 inches per year. Lead estimates tend to exceed cesium estimates by approximately 50%.



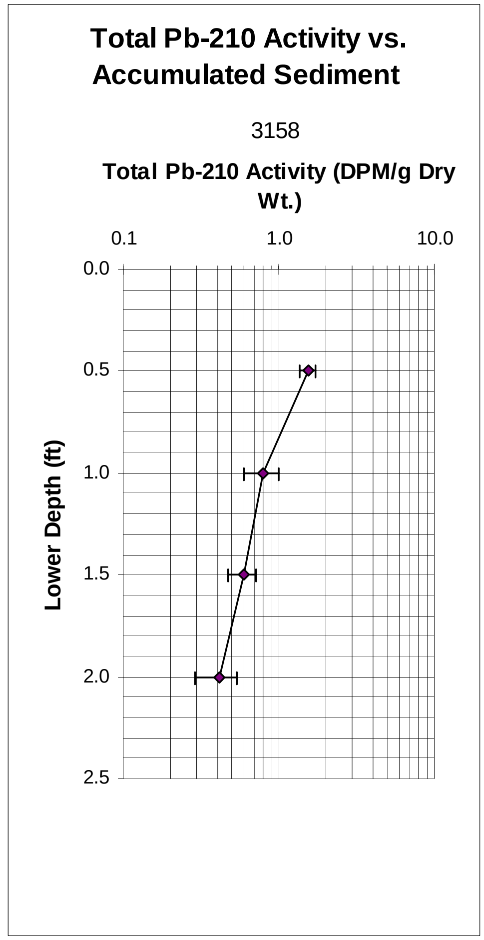


Figure 1. Cesium-137 Profile at Core THT-3160 and Lead-210 Profile at Core FRE-3158.

Table 1 summarizes the radionuclide results, and Figure 2 shows a map of the core locations and estimated accumulation rates.

Table 1. Summary of Radionuclide Measurements

Core ID (Core Depth)	Lead-210 Rate (in/yr)	Cesium-137 Rate (in/yr)	Lead-210 Profile Difficulties	Segment in Which Cesium-137 Was Present
MSE-03150 (3 ft)	0.20	≤ 0.12		0 to 0.5 ft
MSE-03151 (11 ft)	not measurable	≤ 0.13	All depths near background	0 to 0.5 ft, possibly to 1 ft
MSE-03152 (8 ft)	not measurable	≤ 0.13	All depths near background	0 to 0.5 ft, possibly to 1 ft
MSE-03153 (11 ft)	0.31	≤ 0.12		0 to 0.5 ft
MSE-03154 (2 ft)	not measurable	≤ 0.12	All depths near background	0 to 0.5 ft
FRE-03155 (6 ft)	0.14	≤ 0.13		0 to 0.5 ft, possibly to 1 ft
FRE-03156 (8.5 ft)	not measurable	≤ 0.13	All depths near background	0 to 0.5 ft, possibly to 1 ft
FRE-03157 (6.5 ft)	not measurable	≤ 0.12	All depths near background	0 to 0.5 ft
FRE-03158 (2 ft)	0.26	≤ 0.12	results may be due to background Ra-226	0 to 0.5 ft, possibly to 1 ft
FRE-03159 (7.5 ft)	not measurable	≤ 0.12	All depths near background	0 to 0.5 ft
THT-03160 (3 ft)	not measurable	0.15-0.26	All depths near background	0 to 1 ft, if top of section 2 is at 1963, then the rate is 0.15. If the bottom of section 2 is at 1958, then the rate is 0.26.
THT-03161 (2.5 ft)	not measurable	≤ 0.12	All depths near background	0 to 0.5 ft
THT-03162 (6 ft)	0.11	≤ 0.13		0 to 0.5 ft, possibly to 1 ft
THT-03163 (8 ft)	not measurable	≤ 0.12	All depths near background	0 to 0.5 ft
THT-03164 (9 ft)	not measurable	≤ 0.12	Profile is erratic	0 to 0.5 ft

Figure 2. Estimated Soil Accretion Rates Determined from Radionuclide Measurements

5. CONCLUSIONS AND RECOMMENDATIONS

The following subsections of this report present conclusions and recommendations.

5.1. Conclusions

Results of this preliminary investigation indicate that soil accretion rates range from less than 0.12 to 0.26 inches per year, with local variation, particularly near the river.

The following conclusions can be drawn relative to the method utility for this study and associated uncertainties:

- A primary goal of this study was to evaluate the utility of the geochronologic method for determining soil accretion rates. An evaluation of the data collected to date indicates that radionuclide measurements provide valuable local information. Both lead-210 and cesium-137 results are necessary in order to help resolve uncertainties stemming from multiple factors. Such uncertainties can be reduced by joint interpretation of lead-210 and cesium-137 data.

- Geoprobes were not successful at producing cores from which depth horizons could be reliably identified, due to incomplete recovery and compression of the cores during collection. Typical core recoveries for the upper 3 ft averaged 60%.

- Numerous factors may affect accretion rates. In addition to localized effects of floodwater currents, geomorphologic features of the floodplain, such as levees, depressions/wetlands, point bars and overbank deposits may also influence soil accretion. Current data are insufficient to establish these relationships.

5.2. Recommendations

Recommendations for potential future adjustments to the approach and additional studies include the following:

- <u>Finer sectioning to provide more precise soil accretion rate estimates.</u> Radionuclide measurements provide reliable information when vertical profiles are present, however, geochronologic cores collected to date provide insufficient detail at the level of 0.5 ft surficial core sections. Future cores should be sectioned into 0.5 to 1 inch intervals within the first 0.5 ft. Finer sectioning is also necessary to assess spatial patterns of soil accretion rates. Core depth to the groundwater surface should be maintained with analysis of selected deep sections to derive background activity of lead-210 and cesium-137.

- Coring Method Adjustments. The soil coring method used in this round of sampling had low recovery and high uncertainty about the exact vertical position of thin segments. In order to allow reliable thin segmentation of samples near the surface, we propose a two-step sampling approach consisting of manual scraping of soil to 2 feet depth followed by coring for deep samples. The manual approach consists of delineating a one foot square area with 4 graduated stakes pushed two feet vertically into the ground at each corner. After removal of sod, soil is scraped off and collected manually with a stainless steel spoon. The graduated rulers at the corners indicate when the appropriate depth has been reached for individual samples, and the procedure is repeated for each sampling interval. The soil is collected into sample jars. After manual sample collection, deeper samples should be collected using a direct-push sampler through the bottom of the 2 foot depression. Soil is more consolidated at greater depth, and coring is less likely to cause compression of the soil column. The end of the direct push sampler should be fitted with an eggshell catcher to prevent loss of soil from the bottom of the core.
- Soil Accretion as a Function of Geomorphology. To distinguish the impact of various geomorphologic features on soil accretion rates, additional locations should be investigated with the goal of targeting individual features.

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APPENDIX A:
FEBRUARY 8, 2005 FLETT RESEARCH LTD. REPORTED LABORATORY RESULTS FOR LEAD-210 AND CESIUM-137

Fett's Results, printed to pdf, go here.

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The fact that the radionuclides cesium-137 and lead-210 readily and strongly attach to clay and organic particles allows soil and sediment accretion rates to be estimated from activity levels of these two elements. Activity is a measure of concentration related to the radioactivity of the two substances and is measured in units of pico-curies per second or decays per minute. Cesium-137 desorbs more readily from soil particles and is most mobile in sandy soils with low clay and/or organic content, therefore, in some environments, cesium-derived sedimentation rates are associated with a greater level of uncertainty (Huntley et al., 1995; Du et al., 1998; Rowan and Walling 1992).

Lead-210 is a decay product of radon-222 and is present in soils and sediments primarily as a result of recent atmospheric deposition. Radon-222 is a volatile, short-lived intermediate daughter product of uranium-238 decay, a naturally occurring radioisotope found in the earth's crust. Lead-210 is deposited on the earth's surface at a relatively constant rate related to the volatilization rate of radon-222. Once deposited, the activity of lead-210 decreases exponentially with time, with a decay half life of 22 years. This portion of lead-210 is defined as "unsupported lead-210." The only other source of lead-210 is decay of radium-226 (an element similar only in name to radon-222) within the soil/sediment column itself. This portion of lead-210, termed "supported lead-210," must be accounted for (subtracted) when age-dating sediments using lead-210 (Huntley et al., 1995).

Cesium-137 is a man-made isotope produced only during nuclear fission. Cesium-137 first entered the atmosphere during atmospheric testing of nuclear weapons, which began in 1954 and peaked in 1963-1964. Like lead-210, cesium-137 enters the soil/sediment through atmospheric deposition. The depth interval containing sediments deposited in 1954 can be identified because cesium-137 was not present in the natural environment prior to that time. The peak of the cesium-137 soil profile is usually identified in sediments deposited around 1963. Most often, the cesium-137 horizon of 1954 is used as the benchmark depth against which soil and sediment accumulation rates are estimated. These calculations rely on the assumption that the deposition rate has been mostly constant over time (Huntley et al., 1995).

2.2. Sources of Uncertainty and Method Limitations

The assumption of constant depositional rate of cesium-137 may not hold true. However, the assumption of constant deposition can be evaluated using measurements of lead-210. A high correlation between the activities of the two radionuclides indicates greater confidence that cesium-based accretion rates are accurate (Huntley et al., 1995).

Another source of uncertainty derives from the determination of background activity in the soil/sediment column. Measured activity is never truly zero, rather, after a certain depth, activity fluctuates randomly around a very low level (background). The depth at which background activity levels are reached is a necessary input in models used to estimate the accretion rate. For cesium-137, it helps establish the likely depth of the 1954 horizon, and for lead-210, it helps determine the supported fraction of activity. This implies that cores must be deep enough to reach background activity, and at least 3 samples are necessary from the deeper sections to establish its value (Flett, 2005).

Uncertainty is also introduced by the nature of the sedimentary environment. The greater the sediment/soil deposition rate, the greater the extent of dilution of the radionuclides attached to the particle surfaces. At high accretion rates, radionuclide concentrations can be so diluted that measured values can be difficult to distinguish from background. In such cases, sedimentation rates can be difficult or impossible to estimate with radionuclides alone and are generally used in conjuntion with other methods, such as dendrogeochronology. Estimates are also highly uncertain when mixing processes in soils/sediments (e.g. due to erosion/redeposition, bioturbation by worms, moles and other aquatic and terrestrial organisms) alter the initially deposited sediment profile (Flett, 2005; Huntley et al., 1995).

2.3. Calculation of Sedimentation Rates

The local accretion rate based on cesium is calculated simply as the ratio of the thickness of the soil column above the 1954 horizon and the elapsed number of years since 1954 up to the year of sampling.

For lead-210, calculation of accretion rate is more complex, since several factors must enter the calculation: the lead-210 decay constant, the supported activity and the unsupported activity.

Two different models based on different sets of assumptions can be used to estimate sedimentation rates from lead-210, depending on which set of assumptions hold for a given core. In some circumstances, assumptions of both models can be met, and using two models gives a more robust estimate of sedimentation rate. The constant initial concentration model (CIC) assumes a constant initial concentration of unsupported lead-210 and a constant sedimentation rate over the period of time for which the unsupported lead-210 is measurable. The method requires either measurements of sediment porosity to correct for compaction, or cumulative dry weight. The constant rate of supply of unsupported lead-210 model (CRS) assumes a constant supply of lead-210, but it can consider variable sedimentation rate and sediment compaction. Both models assume constant flux of unsupported lead-210 to the sediment-water interface over time. The CRS model requires a core that is long enough to include all of the measurable atmospheric source lead-210 (i.e. background present at depth) (Turner and Delorme, 1996).

With the CIC model sedimentation rates are calculated by solving an equation that balances the total activity of lead-210, A_{tx}, at a given depth x and time t (e.g. a given core segment) against the sum of the radioactive decay of unsupported lead-210 and supported lead-210, A', leading to an equation that can be solved graphically:

$$\ln(A_{tx}-A') = \ln(P/\omega)-(\lambda/S_0)x,$$

where P is the flux of lead-210 at the sediment-water interface in pico-curies per square centimeter per year, ω is the mass sedimentation rate in grams per square centimeter per year, λ is the radioactive decay constant for lead-210 (0.0311/yr) and S_0 is the sedimentation rate in centimeters per year at the sediment-water interface. Graphically, λ/S_0 is the slope of the line plotting x vs. $\ln(A_{tx}-A')$. S_0 is calculated from the slope and the known decay constant. The time t in years since the sample was deposited is given by x/S_0 (Turner and Delorme, 1996).

In the CRS model, the age of a given layer of sediment or soil is calculated from the cumulative unsupported lead-210 *beneath* sediments of a depth x (i.e. background), $B(x)$, and from the total residual unsupported lead-210 in the entire sediment column, $B(0)$. The time is given by

$$t = -(1/\lambda)\cdot\ln[B(x)/B(0)],$$

and $B(x)$ and $B(0)$ are calculated by direct numerical integration of the lead-210 profile (plot of unsupported activity versus cumulative dry weight) (Turner and Delorme, 1996).

3. PROCEDURES AND STUDY DESIGN

This study design was modeled on previous investigations on various floodplains throughout the country where geochronology (in combination with other methods) was successfully used to provide insight into soil/sediment exchange between a river and its floodplain and soil transport within the floodplain (e.g., WRP Technical Note SD-CP-4.1, 1993; Steiger *et al*., 2003; Shroder, 1980; Phipps, *et al*., 1995; Hupp and Morris, 1990; Hupp and Bazemore, 1993; and Heimann and Roell, 2000). In these studies, sampling locations were distributed throughout the floodplain (e.g., Heimann and Roell, 2000), on a regular grid or in transects (Kleiss, 1996), and study length ranged from a single event to 4 years.

This preliminary study utilized measurements of cesium-137 and lead-210 to evaluate long-term depositional rates on the floodplain. The approach selected for this study was to collect soil cores along predefined transects along the Tittabawassee River floodplain downstream of the Dow Midland Plant. Cores were collected from the surface down to the water table and were segmented in smaller intervals to estimate radionuclide activity at various depths and help establish the minimum necessary depth of future cores.

The coring took place in the fall of 2004 at the following three study sites:

1. Dow property near Rockwell Drive (5 cores)
2. Imerman Park (5 cores)
3. Dow Property near Caldwell Boat Launch (5 cores)

Core locations were identified with GPS equipment. The coring locations on the transects are coordinated with other study design elements to allow for comparisons (dendrogeomorphic and clay pad studies).

The cores were extracted with a geoprobe using direct push techniques. The cores penetrated deep enough to reach the groundwater table (between 2 and 11 ft). The Lexan tubes containing the cores were sealed with Teflon® caps and Teflon® tape, the core sections were labeled and were put in a cooler with ice in a vertical position. When possible, geochronologic cores are generally sectioned into thin 0.5-2 inch intervals. In this study, field procedures called for 1-inch sections, but conditions (sandy and wet soil column) resulted in incomplete recovery and significant compaction of the cores. Core recovery was variable across the study area and within each sample location (3 cores were required for each location). Generally core recovery was near 60% for most cores. The low recovery combined with the inconsistent recovery rates within sample locations precluded high vertical resolution due to the uncertainty in assigning each sample to a specific depth. To account for the uncertainty in vertical position of individual samples, the decision was made to analyze the cores in 0.5 foot intervals. The cores were sliced into 0.5 foot intervals in the laboratory (except section 11 in core MSE-03151, which was only 0.17 ft for unspecified reasons, but that did not compromise dating results).

4. RESULTS

The following sections present results of the radionuclide measurements performed by Flett Research, Ltd. Raw data are included in Appendix A.

In each core, between 4 and 17 consecutive 0.5 foot segments were analyzed for cesium-137 and lead-210. The activity of each radionuclide was quantified along with the laboratory/equipment specific uncertainty for that soil segment. A given measurement was considered above background if its error bar did not significantly overlap with the error bars on activities of deeper segments. Cesium-137 was found only in the top 0.5 ft of sediment in 9 of the 15 sample locations. This means that the upper 0.5 ft or less was deposited after 1954 and the sedimentation rate cannot be further refined without the collection of smaller sample intervals. Only one core had significant amounts of cesium-137 in the 0.5 to 1 ft interval (THT-03160 in Imerman Park, Figure 1.). In the remaining cores the presence of some cesium-137 in the 0.5 to 1 ft interval is possible based on background levels, but the results were inconclusive. Thus, each core has a cesium-137 derived *upper bound estimate* on soil accretion rates ranging from 0.12 or less to 0.26 inches per year.

Lead-210 provided estimates of soil accretion rates in only 5 out of the 15 core locations (each of the three study areas had at least one core with an interpretable lead-210 profile, see Figure 2 for example profile at core FRE-3158). The remaining cores had lead-210 measurements at background levels or had vertical or erratic profiles, which could not be interpreted. Such profiles could be due to very high deposition rates and associated dilution of sorbed radionuclides and/or to the action of mixing processes over the time period of deposition. Lead-210-based estimates of soil accretion rates ranged from 0.11 to 0.31 inches per year. Lead estimates tend to exceed cesium estimates by approximately 50%.

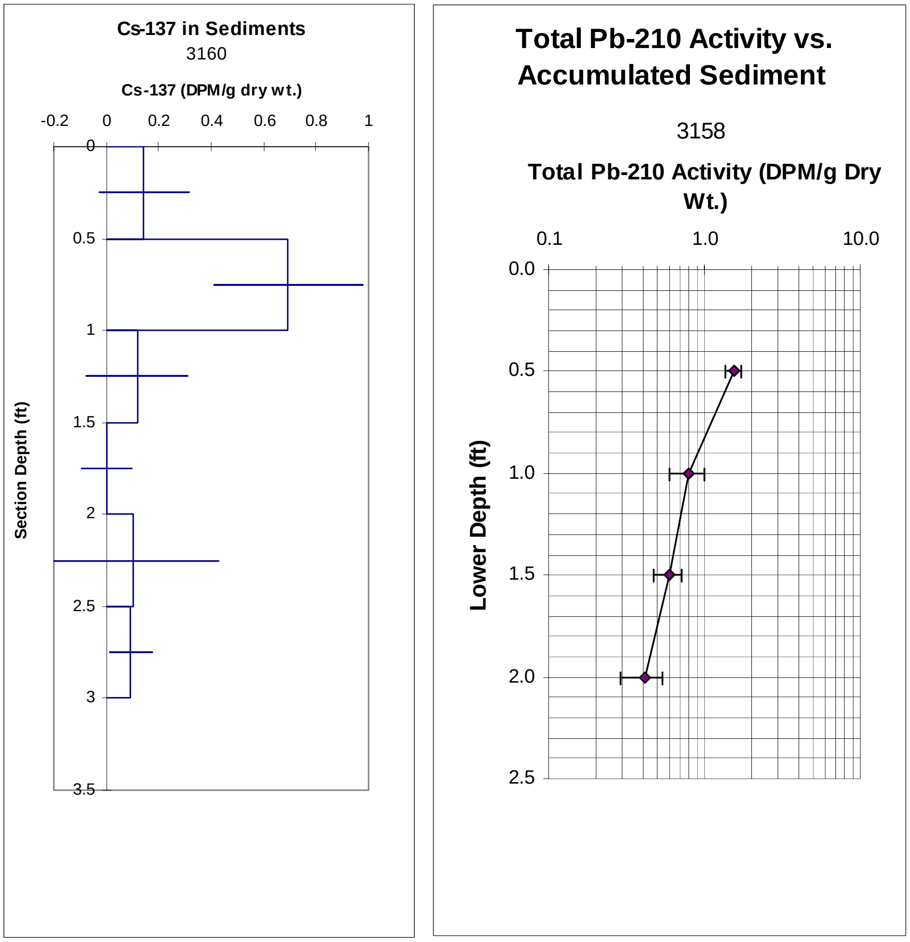
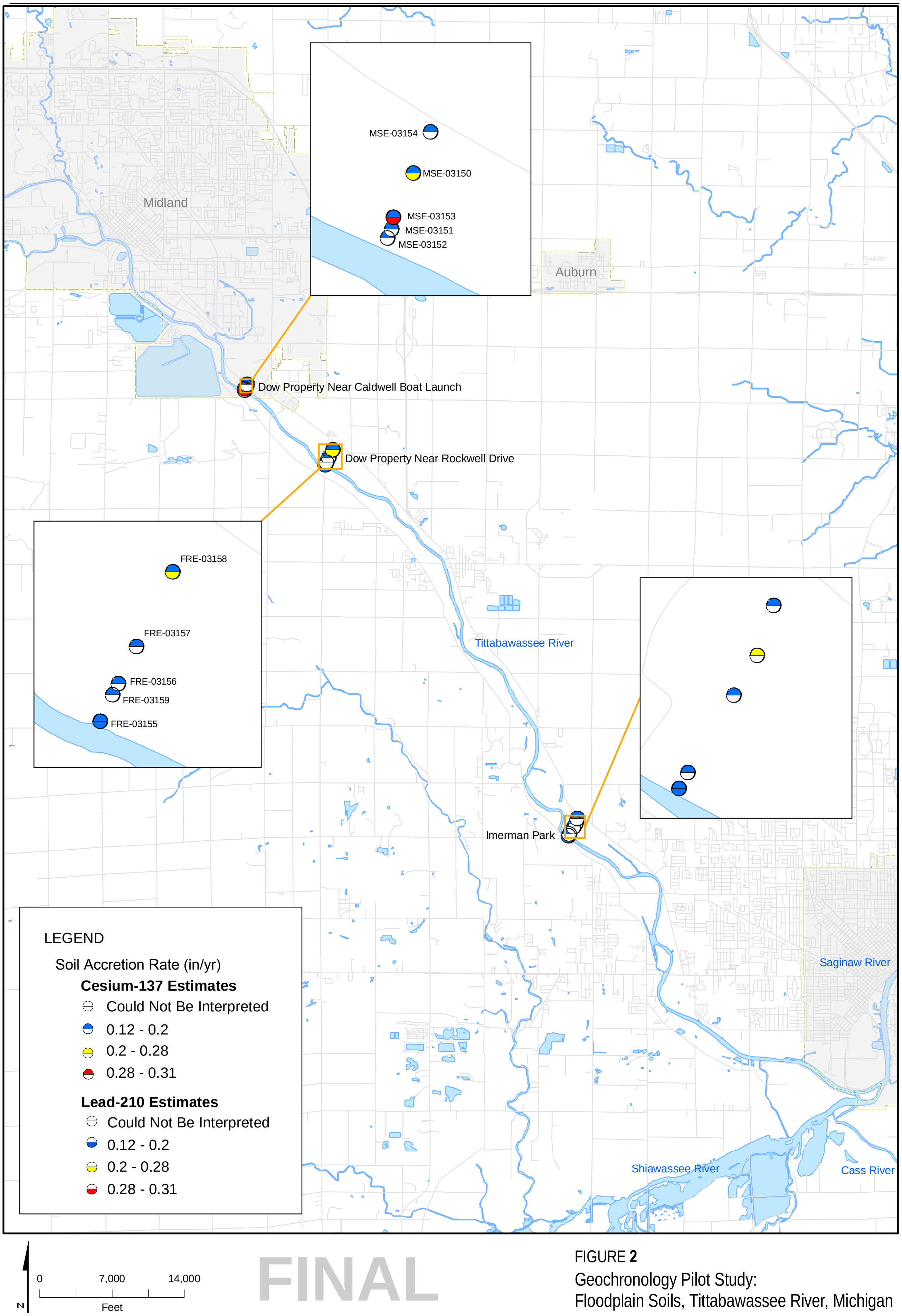


Figure 1. Cesium-137 Profile at Core THT-3160 and Lead-210 Profile at Core FRE-3158.

Table 1 summarizes the radionuclide results, and Figure 2 shows a map of the core locations and estimated accumulation rates.

Table 1. Summary of Radionuclide Measurements

Core ID (Core Depth)	Lead-210 Rate (in/yr)	Cesium-137 Rate (in/yr)	Lead-210 Profile Difficulties	Segment in Which Cesium-137 Was Present
MSE-03150 (3 ft)	0.20	≤ 0.12		0 to 0.5 ft
MSE-03151 (11 ft)	not measurable	≤ 0.13	All depths near background	0 to 0.5 ft, possibly to 1 ft
MSE-03152 (8 ft)	not measurable	≤ 0.13	All depths near background	0 to 0.5 ft, possibly to 1 ft
MSE-03153 (11 ft)	0.31	≤ 0.12		0 to 0.5 ft
MSE-03154 (2 ft)	not measurable	≤ 0.12	All depths near background	0 to 0.5 ft
FRE-03155 (6 ft)	0.14	≤ 0.13		0 to 0.5 ft, possibly to 1 ft
FRE-03156 (8.5 ft)	not measurable	≤ 0.13	All depths near background	0 to 0.5 ft, possibly to 1 ft
FRE-03157 (6.5 ft)	not measurable	≤ 0.12	All depths near background	0 to 0.5 ft
FRE-03158 (2 ft)	0.26	≤ 0.12	results may be due to background Ra-226	0 to 0.5 ft, possibly to 1 ft
FRE-03159 (7.5 ft)	not measurable	≤ 0.12	All depths near background	0 to 0.5 ft
THT-03160 (3 ft)	not measurable	0.15-0.26	All depths near background	0 to 1 ft, if top of section 2 is at 1963, then the rate is 0.15. If the bottom of section 2 is at 1958, then the rate is 0.26.
THT-03161 (2.5 ft)	not measurable	≤ 0.12	All depths near background	0 to 0.5 ft
THT-03162 (6 ft)	0.11	≤ 0.13		0 to 0.5 ft, possibly to 1 ft
THT-03163 (8 ft)	not measurable	≤ 0.12	All depths near background	0 to 0.5 ft
THT-03164 (9 ft)	not measurable	≤ 0.12	Profile is erratic	0 to 0.5 ft



FINAL

FIGURE **2**
Geochronology Pilot Study:
Floodplain Soils, Tittabawassee River, Michigan

CH2MHILL

File Path: U:\GIS\MapDocs\slayden\0385.mxd, Date: 04 28, 2005 3:02:01 PM, User: JHANSEN1

5. CONCLUSIONS AND RECOMMENDATIONS

The following subsections of this report present conclusions and recommendations.

5.1. Conclusions

Results of this preliminary investigation indicate that soil accretion rates range from less than 0.12 to 0.26 inches per year, with local variation, particularly near the river.

The following conclusions can be drawn relative to the method utility for this study and associated uncertainties:

- A primary goal of this study was to evaluate the utility of the geochronologic method for determining soil accretion rates. An evaluation of the data collected to date indicates that radionuclide measurements provide valuable local information. Both lead-210 and cesium-137 results are necessary in order to help resolve uncertainties stemming from multiple factors. Such uncertainties can be reduced by joint interpretation of lead-210 and cesium-137 data.

- Geoprobes were not successful at producing cores from which depth horizons could be reliably identified, due to incomplete recovery and compression of the cores during collection. Typical core recoveries for the upper 3 ft averaged 60%.

- Numerous factors may affect accretion rates. In addition to localized effects of floodwater currents, geomorphologic features of the floodplain, such as levees, depressions/wetlands, point bars and overbank deposits may also influence soil accretion. Current data are insufficient to establish these relationships.

5.2. Recommendations

Recommendations for potential future adjustments to the approach and additional studies include the following:

- <u>Finer sectioning to provide more precise soil accretion rate estimates.</u> Radionuclide measurements provide reliable information when vertical profiles are present, however, geochronologic cores collected to date provide insufficient detail at the level of 0.5 ft surficial core sections. Future cores should be sectioned into 0.5 to 1 inch intervals within the first 0.5 ft. Finer sectioning is also necessary to assess spatial patterns of soil accretion rates. Core depth to the groundwater surface should be maintained with analysis of selected deep sections to derive background activity of lead-210 and cesium-137.

- Coring Method Adjustments. The soil coring method used in this round of sampling had low recovery and high uncertainty about the exact vertical position of thin segments. In order to allow reliable thin segmentation of samples near the surface, we propose a two-step sampling approach consisting of manual scraping of soil to 2 feet depth followed by coring for deep samples. The manual approach consists of delineating a one foot square area with 4 graduated stakes pushed two feet vertically into the ground at each corner. After removal of sod, soil is scraped off and collected manually with a stainless steel spoon. The graduated rulers at the corners indicate when the appropriate depth has been reached for individual samples, and the procedure is repeated for each sampling interval. The soil is collected into sample jars. After manual sample collection, deeper samples should be collected using a direct-push sampler through the bottom of the 2 foot depression. Soil is more consolidated at greater depth, and coring is less likely to cause compression of the soil column. The end of the direct push sampler should be fitted with an eggshell catcher to prevent loss of soil from the bottom of the core.
- Soil Accretion as a Function of Geomorphology. To distinguish the impact of various geomorphologic features on soil accretion rates, additional locations should be investigated with the goal of targeting individual features.

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APPENDIX A:
FEBRUARY 8, 2005 FLETT RESEARCH LTD. REPORTED LABORATORY RESULTS FOR LEAD-210 AND CESIUM-137

Radionuclide Results for Core 3150

Flett Research Ltd.
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Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928
Transaction ID:
PO/Contract No.: 905218

Core ID: 3150
Date(s) Received: Feb 8, 2005
Date(s) Analysed:
Sampling Date(s):
Analyst(s):
Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

There is an apparent drop in the Pb-210 activity as a function of depth in the core (Pages 2 & 3). The surface activity of 4.4 DPM/g is ~ 3.5 times the average background Pb-210 level (average activity of deepest 2 sections) of about 1.19 DPM/g. The surface section is likely above background but the deeper sections may or may not contain excess Pb-210.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

The regression graph on Page 5 includes sections 1 - 4. It assumes constant input of Pb-210 and a constant rate of sediment accumulation. If one assumes that the average activity of the deepest 2 sections (1.19 DPM/g) is the true background, then the closest corresponding sediment accumulation rate in the R2 table on Page 4 (R2 = 0.7652) is about 0.3283 g/cm2/yr . The Regression Plot, using 1.2065 DPM/g background, is seen on Page 5 above the R2 table on the EXCEL sheet. An age of 9.496 g/cm2 / 0.3283 g/cm2/yr = 28.9 yr can be calculated for the bottom of the top section, and an accumulation rate of 0.5 ft / 28.9 yr = 0.017 ft/yr results. The ragged shape of the Pb-210 profile suggests that the accumulation rate is not constant and therefore these predictions should be viewed cautiously.

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

The CRS model includes sections 1- 5. It assumes constant input of Pb-210 and a core that is long enough to include all of the measurable atmospheric source Pb-210. If one assumes that the lowest measured activity in the modelled sections of the core (1.09 DPM/g) is the background Pb-210 level, then the CRS model can be applied. The results are shown in column Z of the main data table. An age of 25.4 years is determined for the bottom of the top section (0.5 ft depth) , corresponding to the year 1979 and a sediment accumulation rate of 0.37 g/cm2/yr or 0.5 ft / 25.4 yr = 0.0197 ft/yr

Conclusion:

Cs-137 is detected only in the top core section, indicating that the bottom edge of the section (at 0.5 ft depth) predates 1954, the year when significant fallout of atmospheric Cs-137 began. Based on this, the sediment accumulation rate is probably less than 0. / (2005 - 1954) = 0.010 ft/yr or 11.538 / 50 = 0.23 g/cm2/yr. This rate is less than the 0.0197 ft /yr predicted by the CRS model and the 0.017 ft/yr predicted by the regression model, but considering the limited data, all three methods are yielding similar results. In this case I am more confident in the Cs-137 results because the accuracy of the Pb-210 methods is compromised with this limited data set.

Results of Cs-137 Analysis

Flett Research Ltd.

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Client: **CH2M HILL - Herb Kelly**
Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928
Core ID: 3150
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Transaction ID:
PO/Contract No.: 905218

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
120704-SOI-03150-00.50	0	0.5	22	12	2004	38	26.3	3600	137			0.01908		0.2125872	0.29526		GAMMA5
120704-SOI-03150-01.00	0.5	1	22	12	2004			3600	121					-0.039405	0.1255854		GAMMA6
120704-SOI-03150-01.50	1	1.5	22	12	2004			3600	146					0.0152026	0.1201686		GAMMA9
120704-SOI-03150-02.00	1.5	2	22	12	2004			3600	150					0.0107515	0.0659118		GAMMA10
120704-SOI-03150-02.50	2	2.5	22	12	2004			3600	159					-0.060251	0.0716616		GAMMA1
120704-SOI-03150-03.00	2.5	3	22	12	2004			3600	166					-0.034898	0.0726384		GAMMA12

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

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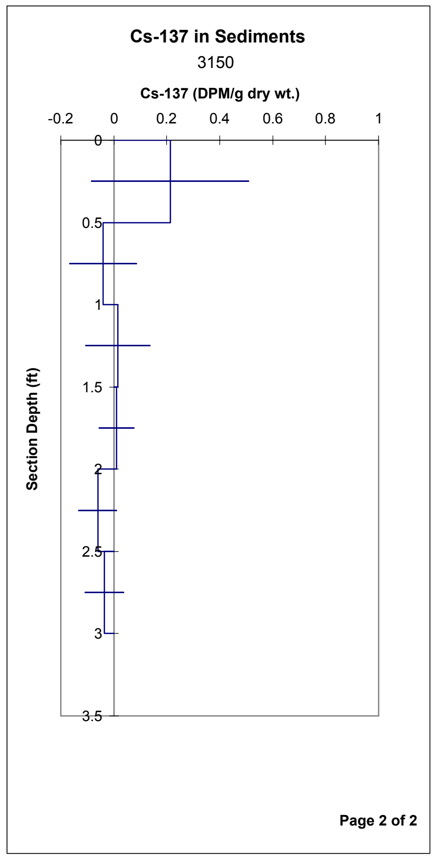
Project:

Date(s) Analysed:
Analyst(s):

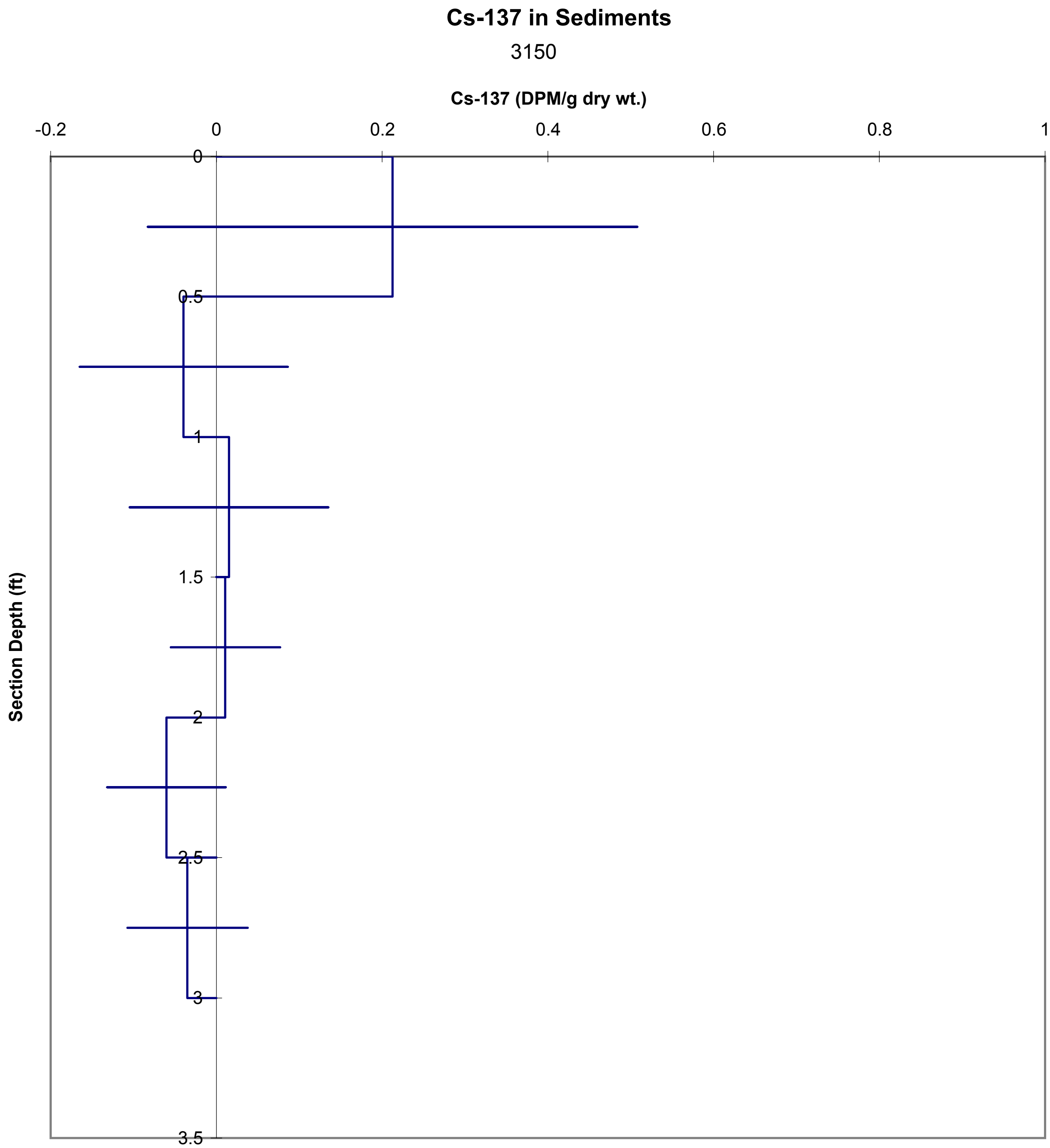
Results authorized by Dr. Robert J. Flett, Chief Scientist

This table must remain open for chart to plot.

Section No.	Sample ID	Upper depth (cm)	Lower depth (cm)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	120704-SOI-03150-00.50	0	0.5	0.21	0.30
2	120704-SOI-03150-01.00	0.5	1	-0.04	0.13
3	120704-SOI-03150-01.50	1	1.5	0.02	0.12
4	120704-SOI-03150-02.00	1.5	2	0.01	0.07
5	120704-SOI-03150-02.50	2	2.5	-0.06	0.07
6	120704-SOI-03150-03.00	2.5	3	-0.03	0.07



Plot Table X Values	Plot Table Y Values
0	0
0.212587	0
0.212587	0.25
0.507847	0.25
-0.08267	0.25
0.212587	0.25
0.212587	0.5
0	0.5
0	0.5
-0.03941	0.5
-0.03941	0.75
0.08618	0.75
-0.16499	0.75
-0.03941	0.75
-0.03941	1
0	1
0	1
0.015203	1
0.015203	1.25
0.135371	1.25
-0.10497	1.25
0.015203	1.25
0.015203	1.5
0	1.5
0	1.5
0.010751	1.5
0.010751	1.75
0.076663	1.75
-0.05516	1.75
0.010751	1.75
0.010751	2
0	2
0	2
-0.06025	2
-0.06025	2.25
0.011411	2.25
-0.13191	2.25
-0.06025	2.25
-0.06025	2.5
0	2.5
0	2.5
-0.0349	2.5
-0.0349	2.75
0.03774	2.75
-0.10754	2.75
-0.0349	2.75
-0.0349	3
0	3



Page 2 of 2

Data Analysis by Flett Research Ltd.
440 DeSalaberry Ave.
Winnipeg, MB
Canada R2L 0Y7
(204) 667-2505

Results of Pb-210 Analysis

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7
Fax/Phone (204) 667-2505
E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Delete extra charts AFTER printing!

Client: **CH2M HILL - Herb Kelly** **Transaction ID:**

Address: 3011 S.W. Williston Road **PO/Contract No.:** 905218

Gainesville, FL 32608-3928

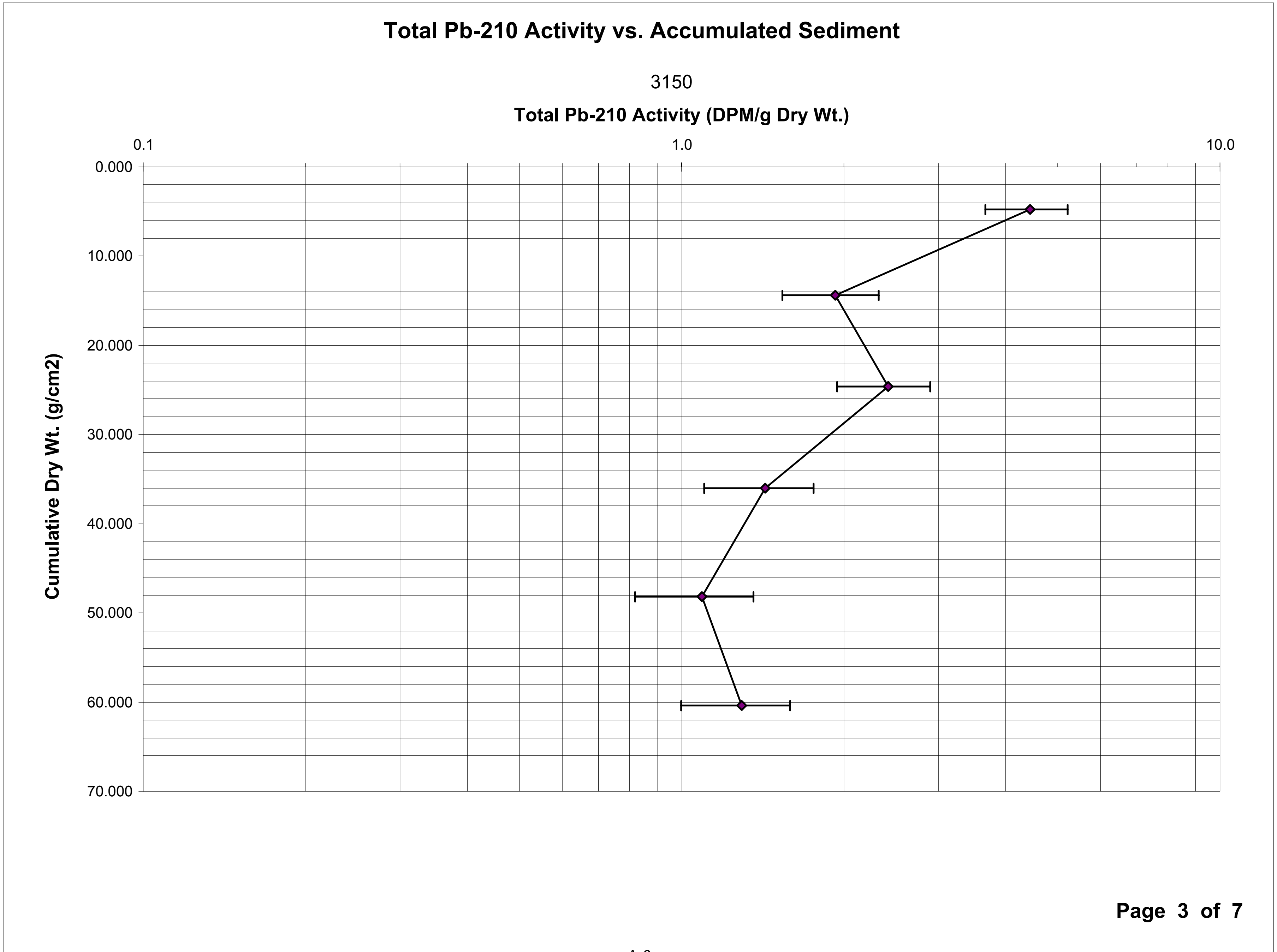
Core ID: 3150

Date(s) Received: Feb. 8, 2005 **Date(s) Analysed:**

Results authorized by Dr. Robert J. Flett, Chief Scientist

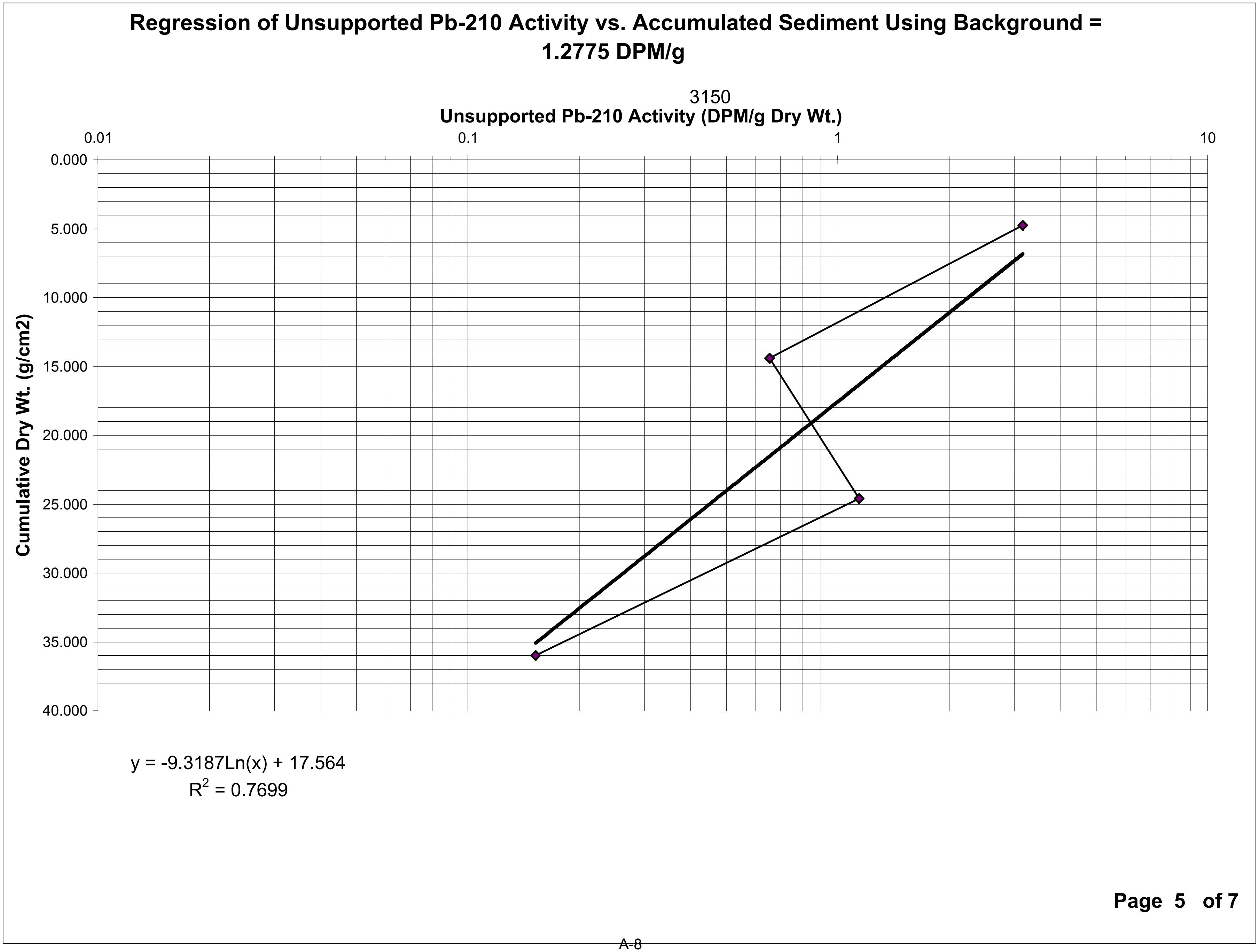
Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrapolated Upper Section Depth (ft)	Extrapolated Lower Section Depth (ft)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrapolated section (g/cm^2)	Cumulative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumulative mass in current section (g/cm^2)	Po-209 counts less detector background	Po-210 counts less detector background	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsupported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (ft)	DPM in Section	CRS Sediment Accumulation Rate ($g/cm^2/yr$)
1		120704-SOI-03150-00.50	127258001	**0.50**	**0.00**	**0.50**	0.00	0.50	0.62309	9.496	9.496	4.748	265.98	412.445	1.560	30300	**4.44**	**0.78**	3.35	**25.4**	0.5	31.81125168	0.3743
2		120704-SOI-03150-01.00	127258002	**0.50**	**0.50**	**1.00**	0.50	1.00	0.643354	9.805	19.301	14.398	263	170.475	1.500	30300	**1.93**	**0.39**	0.84	**37.4**	1	8.249688418	0.8172
3		120704-SOI-03150-01.50	127258003	**0.50**	**1.00**	**1.50**	1.00	1.50	0.696743	10.618	29.919	24.610	250	209.9	1.540	30300	**2.42**	**0.48**	1.33	**85.2**	1.5	14.12029197	0.2222
4		120704-SOI-03150-02.00	127258004	**0.50**	**1.50**	**2.00**	1.50	2.00	0.798156	12.164	42.083	36.001	244	118.96	1.520	30300	**1.43**	**0.33**	0.34			4.131831325	
5		120704-SOI-03150-02.50	127258005	**0.50**	**2.00**	**2.50**	2.00	2.50	0.798738	12.173	54.256	48.169	261	97.485	1.530	30300	**1.09**	**0.27**	0.00			0.000243455	
6		120704-SOI-03150-03.00	127258006	**0.50**	**2.50**	**3.00**	2.50	3.00	0.806321	12.288	66.544	60.400	289	134.9	1.610	30300	**1.29**	**0.30**	0.20			2.510013152	
		120704-SOI-03150-00.50-D	127392014	**0.50**	**0.00**	**0.50**	0.00	0.50	0.632925	9.646	9.646	4.823	429	454.99	1.553	30300	**3.73**	**0.53**					
		120704-SOI-03150-01.00-D	127392015	**0.50**	**0.50**	**1.00**	0.50	1.00	0.756336	11.527	21.172	15.409	528	221.52	1.002	43200	**2.35**	**0.42**					
		120704-SOI-03150-01.50-D	127392016	**0.50**	**1.00**	**1.50**	1.00	1.50	0.76142	11.604	32.776	26.974	389	210.98	1.511	30300	**1.96**	**0.35**					
		120704-SOI-03150-02.00-D	127392017	**0.50**	**1.50**	**2.00**	1.50	2.00	0.784283	11.952	44.729	38.753	346	108.495	1.506	30300	**1.13**	**0.25**					
		120704-SOI-03150-02.50-D	127392018	**0.50**	**2.00**	**2.50**	2.00	2.50	0.750952	11.445	56.173	50.451	466	203.475	1.501	30300	**1.59**	**0.28**					
																		Total Excess DPM in core =			58.31330685		
																Avg. BKG =	**1.19**			Avg. Sed. Rate =			0.4712

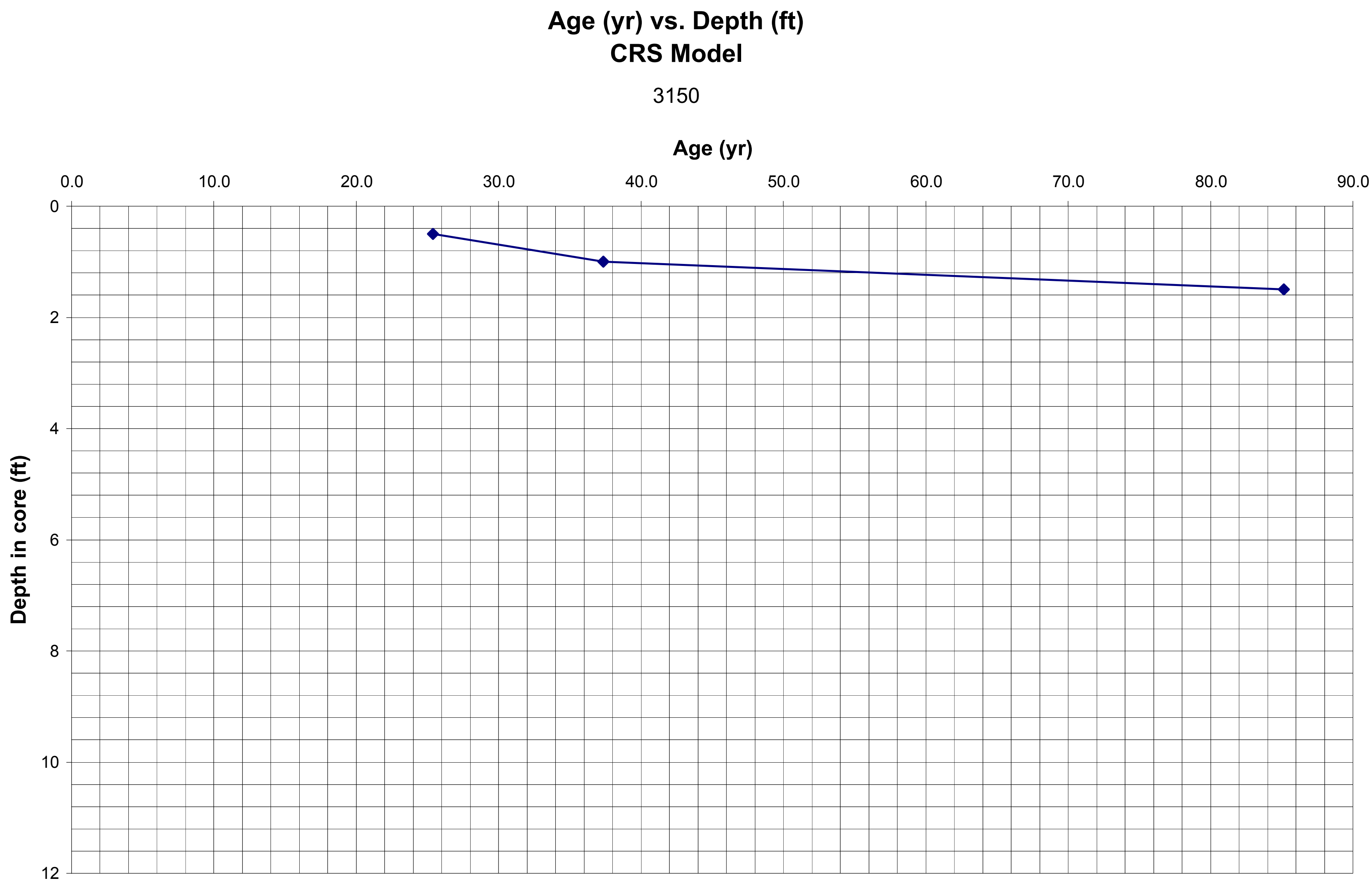
*: See 'Comments' section on 'Interpretation' sheet for discussion.

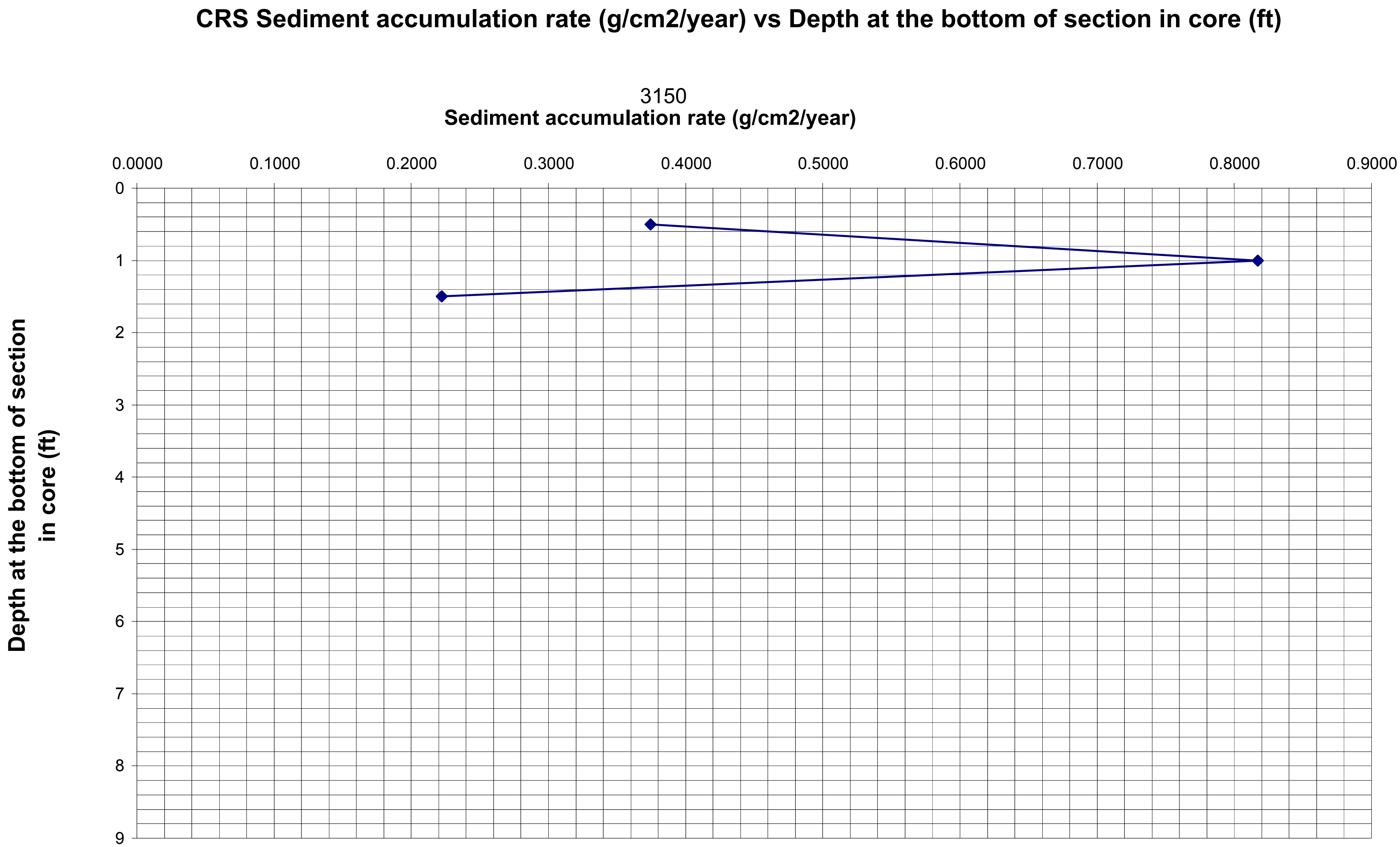

Total Pb-210 Activity vs. Accumulated Sediment
3150
Total Pb-210 Activity (DPM/g Dry Wt.)
0.1
1.0
10.0
0.000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
Cumulative Dry Wt. (g/cm2)

r^2 fit as a function of background subtracted					
bkg (DPM/g)		r^2	Sediment Accumu-lation Rate ($g/cm^2/yr$)	Slope 'm'	Y inter-cept 'b'
0.0000		0.7213	0.7388	-23.77	40.09
0.0710		0.7225	0.7180	-23.10	38.74
0.1419		0.7239	0.6971	-22.43	37.41
0.2129		0.7253	0.6760	-21.75	36.09
0.2838		0.7268	0.6547	-21.07	34.79
0.3548		0.7285	0.6332	-20.37	33.49
0.4257		0.7303	0.6114	-19.67	32.20
0.4967		0.7322	0.5893	-18.96	30.93
0.5676		0.7343	0.5669	-18.24	29.66
0.6386		0.7366	0.5441	-17.51	28.41
0.7095		0.7391	0.5208	-16.76	27.17
0.7805		0.7418	0.4969	-15.99	25.94
0.8515		0.7449	0.4723	-15.20	24.71
0.9225		0.7482	0.4468	-14.38	23.50
0.9935		0.7519	0.4202	-13.52	22.30
1.0645		0.7560	0.3920	-12.61	21.11
1.1355		0.7604	0.3618	-11.64	19.93
1.2065		0.7652	0.3283	-10.56	18.75
1.2775		0.7699	0.2896	-9.32	17.56
1.3485		0.7725	0.2403	-7.73	16.37
1.4195		0.7561	0.1479	-4.76	15.06
Note: Used Column BM for Background Subtraction.					

Note: this table presents results of Pb-210 linear regression model for a range of Pb-210 background activity levels. The model is applied assuming constant sediment accumulation rate. The model is used to generate 20 regressions using different values of background, across the possible range from zero activity to the lowest observed sample activity. The quality of the fit is an indication of the quality of the assumed background activities. The table above shows the R2 value obtained with each choice o background, as well as the corresponding sediment accumulation rate, intercept and slope of the regression line.


Regression of Unsupported Pb-210 Activity vs. Accumulated Sediment Using Background = 1.2775 DPM/g
3150
Unsupported Pb-210 Activity (DPM/g Dry Wt.)
0.01
0.1
1
10
0.000
5.000
10.000
15.000
20.000
25.000
30.000
35.000
40.000
Cumulative Dry Wt. (g/cm2)
y = -9.3187Ln(x) + 17.564
R2 = 0.7699


Age (yr) vs. Depth (ft)
CRS Model
3150
Age (yr)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
Depth in core (ft)
0
2
4
6
8
10
12


CRS Sediment accumulation rate (g/cm2/year) vs Depth at the bottom of section in core (ft)
3150
Sediment accumulation rate (g/cm2/year)
0.0000
0.1000
0.2000
0.3000
0.4000
0.5000
0.6000
0.7000
0.8000
0.9000
0
1
2
3
4
5
6
7
8
9
Depth at the bottom of section in core (ft)

Radionuclide Results for Core 3151

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7

Fax/Phone (204) 667-2505

E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928

Transaction ID:

PO/Contract No.: 905218

Core ID: 3151
Date(s) Received: Feb 8, 2005
Date(s) Analysed:
Sampling Date(s):
Analyst(s):
Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

Pb-210 appears to be above background only in the top section (0 - 0.5 ft) of the core (2.07 DPM/g). The deeper sections of the core (0 11 ft) are probably at background Pb-210 levels, with an average activity of 0.46 DPM/g and little variation throughout the core. The Pb-210 models cannot be applied with only a single section showing excess Pb-210.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

Conclusion:

There is significant Cs-137 in the upper section (0.0 - 0.5 ft) and there may be some Cs-137 in section 2 (0.5 - 1.0 ft).For purposes of calculation, it is assumed that the bottom of section 1 is at 1958 and thus the majority of the Cs-137 has been captured in this section, and , that smaller amounts of the radionuclide, deposited from 1954 - 1958 may be present in section 2. If 1958 occurs at 0.5 ft, then a sediment accumulation rate can estimated to be 0.5 ft / (2004 - 1958) = 0.0109 ft/yr. It is possible that section 2 contains no Cs-137 and therefore the sediment accumulation rate could be significantly lower.

Results of Cs-137 Analysis

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Date(s) Received: Feb. 8, 2005

Sampling Date(s):

Project:

Date(s) Analysed:

Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
120804-SOI-03151-00.50	0	0.5	22	12	2004	91	14.72	3600	155			0.02428		0.471306	0.1524918		GAMMA10
120804-SOI-03151-01.00	0.5	1	22	12	2004			3600	172					0.110778	0.1248306		GAMMA12
120804-SOI-03151-01.50	1	1.5	22	12	2004			3600	168					-0.059585	0.050505		GAMMA18
120804-SOI-03151-02.00	1.5	2	22	12	2004			3600	172					0.0532356	0.0581862		GAMMA16
120804-SOI-03151-02.50	2	2.5	22	12	2004			3600	175					-0.021154	0.0672438		GAMMA17
120804-SOI-03151-03.00	2.5	3	22	12	2004			3600	170					-0.008987	0.0519258		GAMMA18
120804-SOI-03151-05.50	5	5.5	22	12	2004			3600	170					0.0154667	0.0474636		HP
120804-SOI-03151-06.00	5.5	6	22	12	2004			3600	165					-0.005756	0.0659784		GAMMA5
120804-SOI-03151-06.50	6	6.5	22	12	2004			3600	169					0.0455988	0.072261		GAMMA12
120804-SOI-03151-07.00	6.5	7	22	12	2004			3600	165					0.0175602	0.0752358		GAMMA16
120804-SOI-03151-07.17	7	7.17	21	12	2004			60000	21.3					0.0354756	0.247752		WELL
120804-SOI-03151-08.00	7.5	8	22	12	2004			3600	156					0.0215429	0.0856698		GAMMA17
120804-SOI-03151-08.50	8	8.5	22	12	2004			3600	164					-0.017962	0.0494838		HP
120804-SOI-03151-09.00	8.5	9	22	12	2004			3600	174					0.055944	0.099678		GAMMA5
120804-SOI-03151-09.50	9	9.5	22	12	2004			60000	22.7					-0.018619	0.0377844		GAMMA18
120804-SOI-03151-10.50	10	10.5	22	12	2004			3600	166					0.0138262	0.0661782		GAMMA3
120804-SOI-03151-11.00	10.5	11	22	12	2004			3600	179					0.0808302	0.0741036		GAMMA5

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

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E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

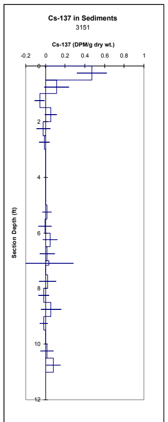
Client: CH2M Hill - Herb Kelly

Core ID: 3151
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section No.	Sample ID	Upper depth (cm)	Lower depth (cm)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	120804-SOI-03151-00.50	0	0.5	0.47	0.15
2	120804-SOI-03151-01.00	0.5	1	0.11	0.12
3	120804-SOI-03151-01.50	1	1.5	-0.06	0.05
4	120804-SOI-03151-02.00	1.5	2	0.05	0.06
5	120804-SOI-03151-02.50	2	2.5	-0.02	0.07
6	120804-SOI-03151-03.00	2.5	3	-0.01	0.05
7	120804-SOI-03151-05.50	5	5.5	0.02	0.05
8	120804-SOI-03151-06.00	5.5	6	-0.01	0.07
9	120804-SOI-03151-06.50	6	6.5	0.05	0.07
10	120804-SOI-03151-07.00	6.5	7	0.02	0.08
11	120804-SOI-03151-07.17	7	7.17	0.04	0.25
12	120804-SOI-03151-08.00	7.5	8	0.02	0.09
13	120804-SOI-03151-08.50	8	8.5	-0.02	0.05
14	120804-SOI-03151-09.00	8.5	9	0.06	0.10
15	120804-SOI-03151-09.50	9	9.5	-0.02	0.04
16	120804-SOI-03151-10.50	10	10.5	0.01	0.07
17	120804-SOI-03151-11.00	10.5	11	0.08	0.07

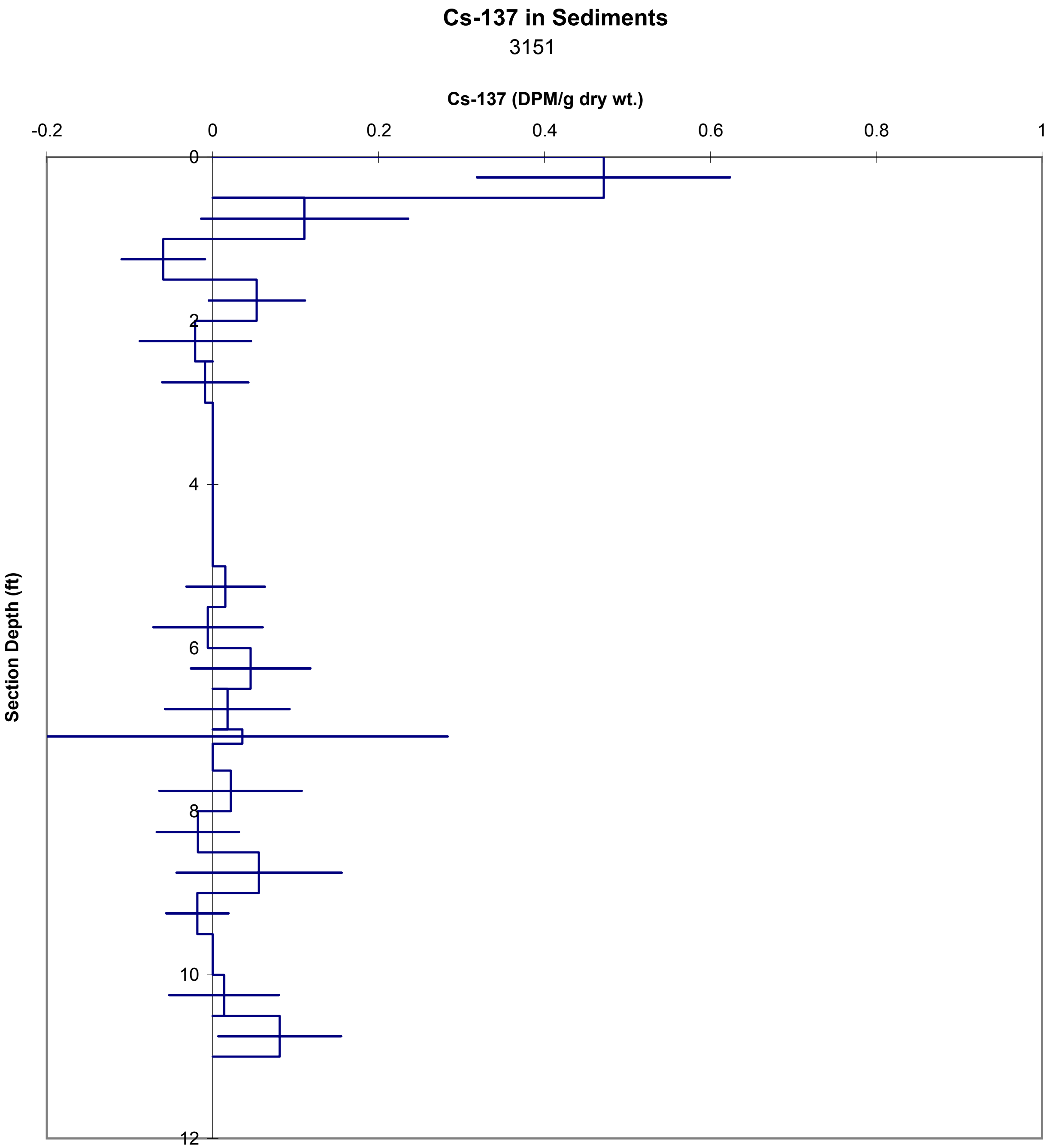


Page 2 of 2

This table must remain open for chart to plot.

Plot Table X Values	Plot Table Y Values
0	0
0.47131	0
0.47131	0.25
0.6238	0.25
0.31881	0.25
0.47131	0.25
0.47131	0.5
0	0.5
0	0.5
0.11078	0.5
0.11078	0.75
0.23561	0.75
-0.01405	0.75
0.11078	0.75
0.11078	1
0	1
0	1
-0.05958	1
-0.05958	1.25
-0.00908	1.25
-0.11009	1.25
-0.05958	1.25
-0.05958	1.5
0	1.5
0	1.5
0.05324	1.5
0.05324	1.75
0.11142	1.75
-0.00495	1.75
0.05324	1.75
0.05324	2
0	2
0	2
-0.02115	2
-0.02115	2.25
0.04609	2.25
-0.0884	2.25
-0.02115	2.25
-0.02115	2.5
0	2.5
0	2.5
-0.00899	2.5
-0.00899	2.75
0.04294	2.75
-0.06091	2.75
-0.00899	2.75
-0.00899	3
0	3
0	5
0.01547	5
0.01547	5.25
0.06293	5.25
-0.032	5.25
0.01547	5.25
0.01547	5.5
0	5.5
0	5.5
-0.00576	5.5
-0.00576	5.75
0.06022	5.75
-0.07173	5.75
-0.00576	5.75
-0.00576	6
0	6
0	6
0.0456	6
0.0456	6.25
0.11786	6.25
-0.02666	6.25
0.0456	6.25
0.0456	6.5
0	6.5
0	6.5
0.01756	6.5
0.01756	6.75
0.0928	6.75
-0.05768	6.75
0.01756	6.75
0.01756	7
0	7
0	7
0.03548	7
0.03548	7.085
0.28323	7.085
-0.21228	7.085
0.03548	7.085
0.03548	7.17
0	7.17
0	7.5
0.02154	7.5
0.02154	7.75
0.10721	7.75
-0.06413	7.75
0.02154	7.75
0.02154	8
0	8
0	8
-0.01796	8
-0.01796	8.25
0.03152	8.25
-0.06745	8.25
-0.01796	8.25
-0.01796	8.5
0	8.5
0	8.5
0.05594	8.5
0.05594	8.75
0.15562	8.75
-0.04373	8.75
0.05594	8.75
0.05594	9
0	9
0	9
-0.01862	9
-0.01862	9.25
0.01917	9.25
-0.0564	9.25
-0.01862	9.25
-0.01862	9.5
0	9.5
0	10
0.01383	10
0.01383	10.25
0.08	10.25
-0.05235	10.25
0.01383	10.25
0.01383	10.5
0	10.5
0	10.5
0.08083	10.5
0.08083	10.75
0.15493	10.75
0.00673	10.75
0.08083	10.75
0.08083	11
0	11

Herb Kelly
CH2M Hill
Gainesville, FL



Data Analysis by Flett Research Ltd.
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Canada R2L 0Y7
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4/28/2005

Results of Pb-210 Analysis

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Delete extra charts AFTER printing!

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PO/Contract No.: 905218

Core ID: 3151

Date(s) Received: Feb. 8, 2005

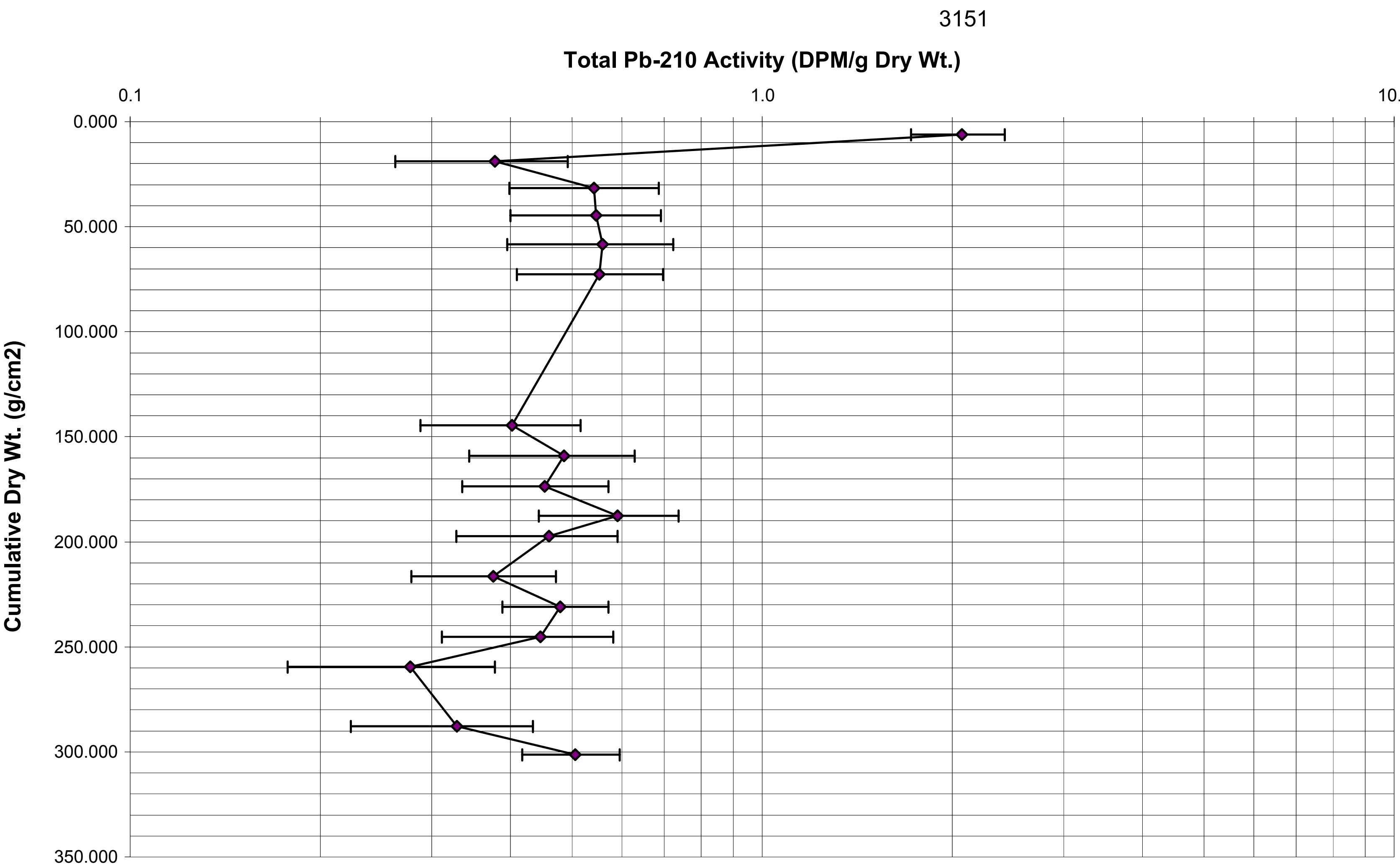
Date(s) Analysed:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1		120804-SOI-03151-00.5C	127269001	**0.50**	**0.00**	**0.50**	0.0	0.5	0.810	12.337	12.337	6.169	355.455	273.93	1.678	30300	**2.07**	**0.35**	1.59			
2		120804-SOI-03151-01.0C	127269002	**0.50**	**0.50**	**1.00**	0.5	1.0	0.857	13.055	25.392	18.865	423.485	56.93	1.604	30300	**0.38**	**0.11**				
3		120804-SOI-03151-01.5C	127269003	**0.50**	**1.00**	**1.50**	1.0	1.5	0.832	12.673	38.065	31.729	342.455	68	1.657	30300	**0.54**	**0.14**				
4		120804-SOI-03151-02.0C	127269004	**0.50**	**1.50**	**2.00**	1.5	2.0	0.867	13.214	51.279	44.672	395.475	73.97	1.546	30300	**0.55**	**0.15**				
5		120804-SOI-03151-02.5C	127269005	**0.50**	**2.00**	**2.50**	2.0	2.5	0.941	14.334	65.613	58.446	329.475	66.425	1.624	30300	**0.56**	**0.16**				
6		120804-SOI-03151-03.0C	127269006	**0.50**	**2.50**	**3.00**	2.5	4.0	0.928	42.446	108.059	72.688	398.97	80.96	1.656	30300	**0.55**	**0.14**				
7		120804-SOI-03151-05.5C	127269007	**0.50**	**5.00**	**5.50**	4.0	5.5	0.959	43.831	151.889	144.584	471.475	64.95	1.549	30300	**0.40**	**0.11**				
8		120804-SOI-03151-06.0C	127269008	**0.50**	**5.50**	**6.00**	5.5	6.0	0.941	14.348	166.237	159.063	392.255	64.435	1.528	30300	**0.49**	**0.14**				
9		120804-SOI-03151-06.5C	127269009	**0.50**	**6.00**	**6.50**	6.0	6.5	0.950	14.481	180.718	173.478	459.96	73.96	1.600	30300	**0.45**	**0.12**				
10		120804-SOI-03151-07.0C	127269010	**0.50**	**6.50**	**7.00**	6.5	7.0	0.922	14.049	194.767	187.743	400.96	81.97	1.564	30300	**0.59**	**0.15**				
11		120804-SOI-03151-07.17	127269011	**0.17**	**7.00**	**7.17**	7.0	7.3	0.940	9.598	204.365	197.203	384.455	62.455	1.594	30300	**0.46**	**0.13**				
12		120804-SOI-03151-08.0C	127269012	**0.50**	**7.50**	**8.00**	7.3	8.0	0.962	19.501	223.866	216.535	537.475	70.98	1.588	30300	**0.38**	**0.10**				
13		120804-SOI-03151-08.5C	127269013	**0.50**	**8.00**	**8.50**	8.0	8.5	0.931	14.194	238.060	230.963	903	146	1.533	60000	**0.48**	**0.09**				
14		120804-SOI-03151-09.0C	127269014	**0.50**	**8.50**	**9.00**	8.5	9.0	0.946	14.414	252.474	245.267	357.435	58.95	1.667	30300	**0.45**	**0.13**				
15		120804-SOI-03151-09.5C	127269015	**0.50**	**9.00**	**9.50**	9.0	9.8	0.926	21.158	273.632	259.526	431.475	39.95	1.507	30300	**0.28**	**0.10**				
16		120804-SOI-03151-10.5C	127269016	**0.50**	**10.00**	**10.50**	9.8	10.5	0.922	21.080	294.712	287.685	398.475	45	1.546	30300	**0.33**	**0.11**				
17		120804-SOI-03151-11.0C	127269017	**0.50**	**10.50**	**11.00**	10.5	11.0	0.871	13.279	307.991	301.352	928	171	1.649	60000	**0.51**	**0.09**				
																		Total Excess DPM in core =			19.63198653	
																Avg. BKG =	**0.46**			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussion

Total Pb-210 Activity vs. Accumulated Sediment



Radionuclide Results for Core 3152

Flett Research Ltd.
440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7
Fax/Phone (204) 667-2505
E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928
Transaction ID:
PO/Contract No.: 905218
Core ID: 3152
Date(s) Received: Feb 8, 2005
Date(s) Analysed:
Sampling Date(s):
Analyst(s):
Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

Pb-210 appears to be above background only in the top section (0.5 - 1.0 ft) of the core (4.40 DPM/g). The deeper sections of the core (0.5 - 8 ft) are probably at background Pb-210 levels, with an average activity of 0.70 DPM/g. There is an apparent slow drop in background activity with depth but this is attributed to varying Ra-226 concentrations, not atmospheric source Pb-210. The Pb-210 models cannot be applied with only a single section showing excess Pb-210.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

Conclusion:

There is significant Cs-137 in the upper section (0.0 - 0.5 ft) and there may be some Cs-137 in section 2 (0.5 - 1.0 ft).For purposes of calculation, it is assumed that the bottom of section 1 is at 1958 and thus the majority of the Cs-137 has been captured in this section, and , that smaller amounts of the radionuclide, deposited from 1954 - 1958 may be present in section 2. If 1958 occurs at 0.5 ft, then a sediment accumulation rate can estimated to be 0.5 ft / (2004 - 1958) = 0.0109 ft/yr. It is possible that section 2 contains no Cs-137 and therefore the sediment accumulation rate could be significantly lower.

Results of Cs-137 Analysis

Flett Research Ltd.

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Client: **CH2M HILL - Herb Kelly**

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

Core ID: 3152

Date(s) Received: Feb. 8, 2005

Sampling Date(s):

Project:

Transaction ID:

PO/Contract No.: 905218

Date(s) Analysed:

Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
120804-SOI-03152-00.50	0	0.5	22	12	2004	117	7.96	3600	125			0.02214		0.828282	0.225552		GAMMA16
120804-SOI-03152-01.00	0.5	1	22	12	2004			3600	168					0.0669108	0.085803		GAMMA17
120804-SOI-03152-01.50	1	1.5	22	12	2004			3600	165					-0.007639	0.0553668		GAMMA18
120804-SOI-03152-02.00	1.5	2	22	12	2004			3600	141					0.0456654	0.061716		HP
120804-SOI-03152-02.50	2	2.5	22	12	2004			3600	154					0.0125008	0.0666666		GAMMA8
120804-SOI-03152-03.00	2.5	3	22	12	2004			3600	153					-0.082828	0.1014096		GAMMA5
120804-SOI-03152-05.50	5	5.5	22	12	2004			3600	175					0.0055988	0.067932		GAMMA6
120804-SOI-03152-06.00	5.5	6	22	12	2004			3600	167					-0.025264	0.0789654		GAMMA9
120804-SOI-03152-06.50	6	6.5	22	12	2004			3600	153					-0.007723	0.0582306		GAMMA10
120804-SOI-03152-07.00	6.5	7	22	12	2004			3600	155					0.0716616	0.0774114		GAMMA12
120804-SOI-03152-07.50	7	7.5	22	12	2004			3600	175					0.000232	0.0664668		GAMMA16
120804-SOI-03152-08.00	7.5	8	22	12	2004			3600	159					0.0560994	0.0757686		GAMMA17

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

Flett Research Ltd.
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Client: CH2M Hill - Herb Kelly

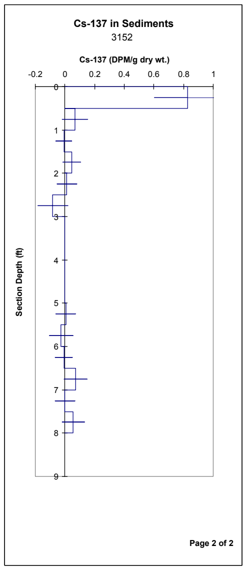
Core ID: 3152
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

This table must remain open for chart to plot.

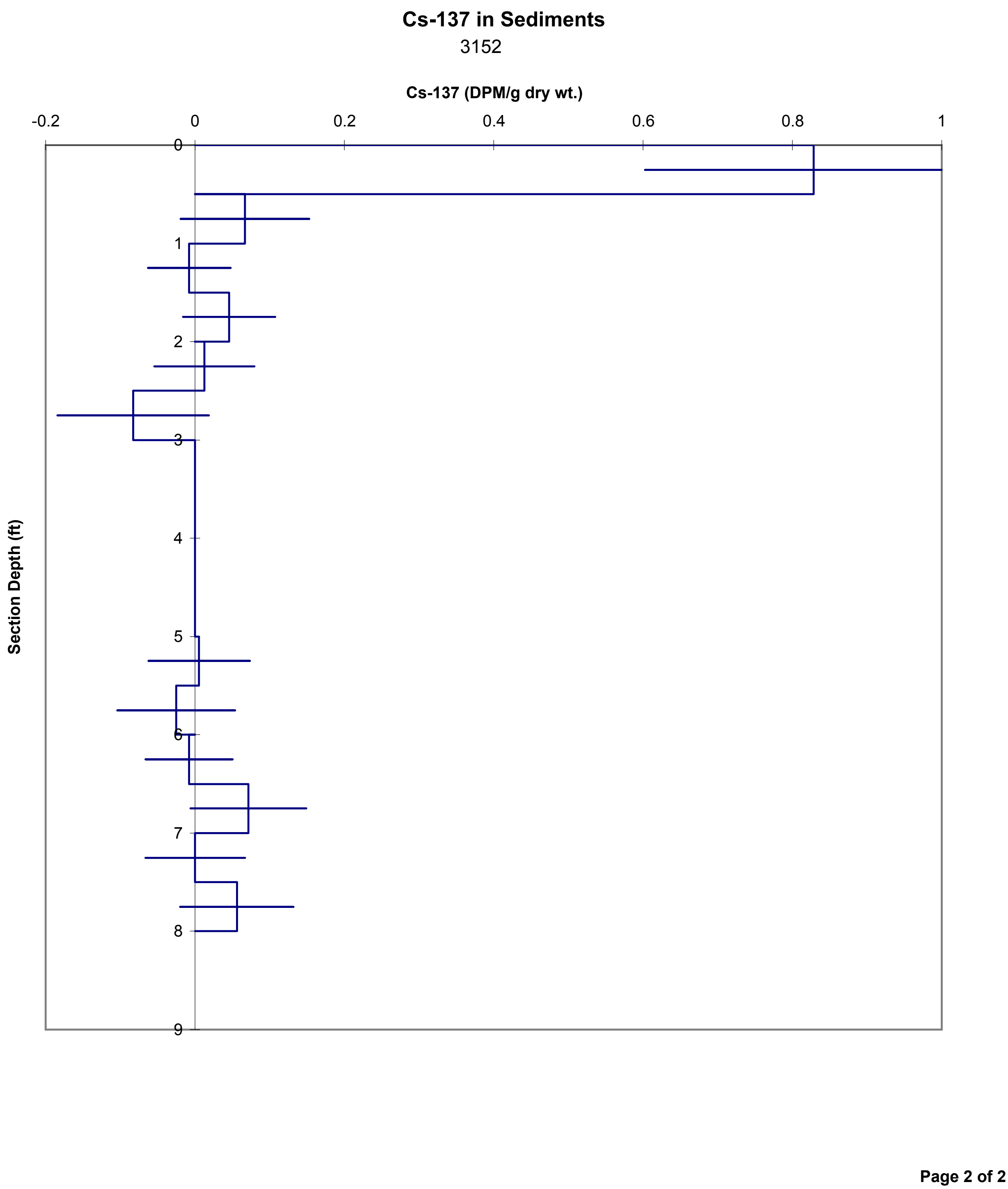
Results authorized by Dr. Robert J. Flett, Chief Scientist

Section No.	Sample ID	Upper depth (cm)	Lower depth (cm)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	120804-SOI-03152-00.50	0	0.5	0.83	0.23
2	120804-SOI-03152-01.00	0.5	1	0.07	0.09
3	120804-SOI-03152-01.50	1	1.5	-0.01	0.06
4	120804-SOI-03152-02.00	1.5	2	0.05	0.06
5	120804-SOI-03152-02.50	2	2.5	0.01	0.07
6	120804-SOI-03152-03.00	2.5	3	-0.08	0.10
7	120804-SOI-03152-05.50	5	5.5	0.01	0.07
8	120804-SOI-03152-06.00	5.5	6	-0.03	0.08
9	120804-SOI-03152-06.50	6	6.5	-0.01	0.06
10	120804-SOI-03152-07.00	6.5	7	0.07	0.08
11	120804-SOI-03152-07.50	7	7.5	0.00	0.07
12	120804-SOI-03152-08.00	7.5	8	0.06	0.08



Plot Table X Values	Plot Table Y Values
0	0
0.82828	0
0.82828	0.25
1.05383	0.25
0.60273	0.25
0.82828	0.25
0.82828	0.5
0	0.5
0	0.5
0.06691	0.5
0.06691	0.75
0.15271	0.75
-0.01889	0.75
0.06691	0.75
0.06691	1
0	1
0	1
-0.00764	1
-0.00764	1.25
0.04773	1.25
-0.06301	1.25
-0.00764	1.25
-0.00764	1.5
0	1.5
0	1.5
0.04567	1.5
0.04567	1.75
0.10738	1.75
-0.01605	1.75
0.04567	1.75
0.04567	2
0	2
0	2
0.0125	2
0.0125	2.25
0.07917	2.25
-0.05417	2.25
0.0125	2.25
0.0125	2.5
0	2.5
0	2.5
-0.08283	2.5
-0.08283	2.75
0.01858	2.75
-0.18424	2.75
-0.08283	2.75
-0.08283	3
0	3
0	5
0.0056	5
0.0056	5.25
0.07353	5.25
-0.06233	5.25
0.0056	5.25
0.0056	5.5
0	5.5
0	5.5
-0.02526	5.5
-0.02526	5.75
0.0537	5.75
-0.10423	5.75
-0.02526	5.75
-0.02526	6
0	6
0	6
-0.00772	6
-0.00772	6.25
0.05051	6.25
-0.06595	6.25
-0.00772	6.25
-0.00772	6.5
0	6.5
0	6.5
0.07166	6.5
0.07166	6.75
0.14907	6.75
-0.00575	6.75
0.07166	6.75
0.07166	7
0	7
0	7
0.00023	7
0.00023	7.25
0.0667	7.25
-0.06623	7.25
0.00023	7.25
0.00023	7.5
0	7.5
0	7.5
0.0561	7.5
0.0561	7.75
0.13187	7.75
-0.01967	7.75
0.0561	7.75
0.0561	8
0	8

Herb Kelly
CH2M Hill
Gainesville, FL



Data Analysis by Flett Research Ltd.
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4/28/2005

Results of Pb-210 Analysis

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Client: CH2M HILL - Herb Kelly

Transaction ID:

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

PO/Contract No.: 905218

Core ID: 3152

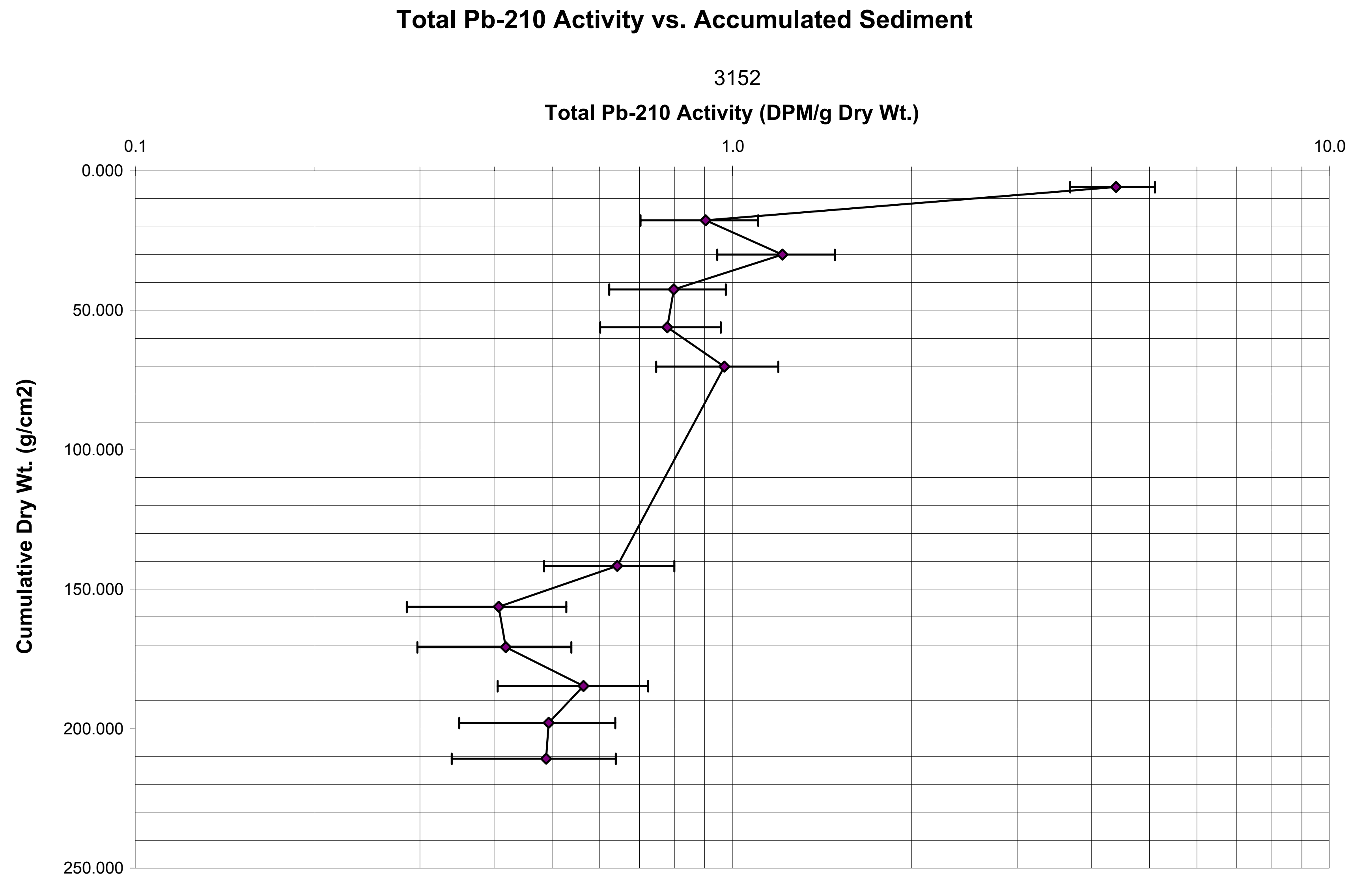
Date(s) Received: Feb. 8, 2005

Date(s) Analysed:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1	127258007	0.50	0.00	0.50	0.0	0.5	0.754	11.496	11.496	5.748	327.455	506.92	1.570	30300	4.40	0.71	3.70			
2	127258008	0.50	0.50	1.00	0.5	1.0	0.815	12.418	23.913	17.705	382	124.95	1.610	30300	0.90	0.20				
3	127258009	0.50	1.00	1.50	1.0	1.5	0.799	12.174	36.087	30.000	327	140.405	1.570	30300	1.21	0.27				
4	127258010	0.50	1.50	2.00	1.5	2.0	0.851	12.965	49.052	42.570	402	113.95	1.570	30300	0.80	0.18				
5	127258011	0.50	2.00	2.50	2.0	2.5	0.933	14.221	63.273	56.163	391	102.96	1.500	30300	0.78	0.18				
6	127258012	0.50	2.50	3.00	2.5	4.0	0.910	41.594	104.867	70.205	324	107.95	1.520	30300	0.97	0.22				
7	127258013	0.50	5.00	5.50	4.0	5.5	0.967	44.200	149.067	141.701	358	85.475	1.660	30300	0.64	0.16				
8	127258014	0.50	5.50	6.00	5.5	6.0	0.949	14.456	163.524	156.296	412	60.94	1.620	30300	0.41	0.12				
9	127258015	0.50	6.00	6.50	6.0	6.5	0.950	14.472	177.995	170.759	418	60.97	1.550	30300	0.42	0.12				
10	127258016	0.50	6.50	7.00	6.5	7.0	0.873	13.309	191.304	184.650	342	65.98	1.520	30300	0.56	0.16				
11	127258017	0.50	7.00	7.50	7.0	7.5	0.854	13.017	204.321	197.812	357	61.465	1.550	30300	0.49	0.14				
12	127258018	0.50	7.50	8.00	7.5	8.0	0.838	12.775	217.096	210.708	308	56.465	1.660	30300	0.49	0.15				
															Total Excess DPM in core =			42.48331069	
														Avg. BKG =	0.70			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussio


Total Pb-210 Activity vs. Accumulated Sediment
3152
Total Pb-210 Activity (DPM/g Dry Wt.)
0.1
1.0
10.0
0.000
50.000
100.000
150.000
200.000
250.000
Cumulative Dry Wt. (g/cm2)

Page 3 of 7

Radionuclide Results for Core 3153

Flett Research Ltd.

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Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928

Transaction ID:

PO/Contract No.: 905218

Core ID: 3153

Date(s) Received: Feb 8, 2005

Date(s) Analysed:

Sampling Date(s):

Analyst(s):

Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

The surface section (6 - 12 in) has a Pb-210 activity of 2.19 DPM/g which is significantly above the average activity of 0.48 DPM/g seen in the bottom 11 sections. The 2nd section (6 - 12 in) at 1.39 DPM/g may be above background also. Variation in the apparent background (0.28 - 0.81 DPM/g) makes it difficult to determine where background Pb-210 begins.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2

The regression graph on Page 5 includes sections 1 - 2. It assumes constant input of Pb-210 and a constant rate of sediment accumulation. If one assumes that the average activity of the deepest 11sections (0.48 DPM/g) is the true background, then the closest corresponding sediment accumulation rate in the R2 table on Page 4 (R2 = 1.000) is about 0.5904 g/cm2/yr . The Regression Plot, using 0.4795 DPM/g background, is seen on Page 5 above the R2 table on the EXCEL sheet. There are only 2 points available for this fit and therefore the R2 value is meaningless (always = 1.00). An age of 11.538 g/cm2 / 0.5904 g/cm2/yr = 19.5 yr can be calculated for the bottom of the top section, and an accumulation rate of 0.5 ft / 19.5 yr = 0.026 ft/yr results.

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm

The CRS model includes sections 1- 3. It assumes constant input of Pb-210 and a core that is long enough to include all of the measurable atmospheric source Pb-210. If one assumes that the lowest measured activity in the modelled sections of the core (0.61 DPM/g) is the background Pb-210 level, then the CRS model can be applied. The results are shown in column Z of the main data table. An age of 34 years is determined for the bottom of the top section (6 in depth) , corresponding to the year 1970 and a sediment accumulation rate of 0.34 g/cm2/yr or 0.5 ft / 34.2 yr = 0.0146 ft/yr There are insufficient data points to date any other sections.

Conclusion:

Cs-137 is detected only in the top core section, indicating that the bottom edge of the section (at 0.5 ft depth) predates 1954, the year when significant fallout of atmospheric Cs-137 began. Based on this, the sediment accumulation rate is probably less than 0.5 ft / (2004 - 1954) = 0.01 ft/yr or 11.538 / 50 = 0.23 g/cm2/yr. This rate is less than the 0.0146 ft /yr predicted by the CRS model and the 0.026 ft/yr predicted by the regression model, but considering the limited data, all three methods are yielding similar results. In this case I am more confident in the Cs-137 results because the accuracy of the Pb-210 methods is compromised with this limited data set.

Results of Cs-137 Analysis

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Client: **CH2M HILL - Herb Kelly**

Address: 3011 S.W. Williston Road
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Transaction ID:

PO/Contract No.: 905218

Core ID: 3153

Date(s) Received: Feb. 8, 2005

Sampling Date(s):

Project:

Date(s) Analysed:

Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
120704-SOI-03153-00.50	0	0.5	22	12	2004	67	12.21	3600	143			0.01906		0.482184	0.1758018		GAMMA5
120704-SOI-03153-01.00	0.5	1	22	12	2004			3600	149					-0.084848	0.0943278		GAMMA6
120704-SOI-03153-01.50	1	1.5	22	12	2004			3600	174					0.0598512	0.0769008		GAMMA9
120704-SOI-03153-02.00	1.5	2	22	12	2004			3600	172					0.0295482	0.072594		GAMMA10
120704-SOI-03153-02.50	2	2.5	22	12	2004			3600	167					0.0445554	0.0752136		GAMMA17
120704-SOI-03153-03.00	2.5	3	22	12	2004			3600	159					-0.034543	0.0507492		GAMMA18
120704-SOI-03153-05.50	5	5.5	22	12	2004			3600	153					0.0140526	0.0448884		HP
120704-SOI-03153-06.00	5.5	6	22	12	2004			3600	167					-0.017842	0.0805416		GAMMA2
120704-SOI-03153-06.50	6	6.5	22	12	2004			3600	181					-0.052525	0.06438		GAMMA2
120704-SOI-03153-07.00	6.5	7	22	12	2004			3600	172					-0.00817	0.0836718		GAMMA5
120704-SOI-03153-07.50	7	7.5	22	12	2004			3600	147					-0.007484	0.0870018		GAMMA7
120704-SOI-03153-10.50	10	10.5	22	12	2004			3600	172					-0.039583	0.0688644		GAMMA9
120704-SOI-03153-11.00	10.5	11	22	12	2004			3600	172					0.0017391	0.0601398		GAMMA10

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

Flett Research Ltd.
440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7
Fax/Phone (204) 667-2505
E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M Hill - Herb Kelly

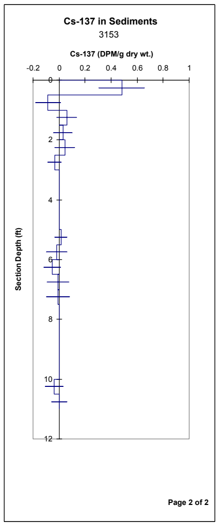
Core ID: 3153
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

This table must remain open for chart to plot.

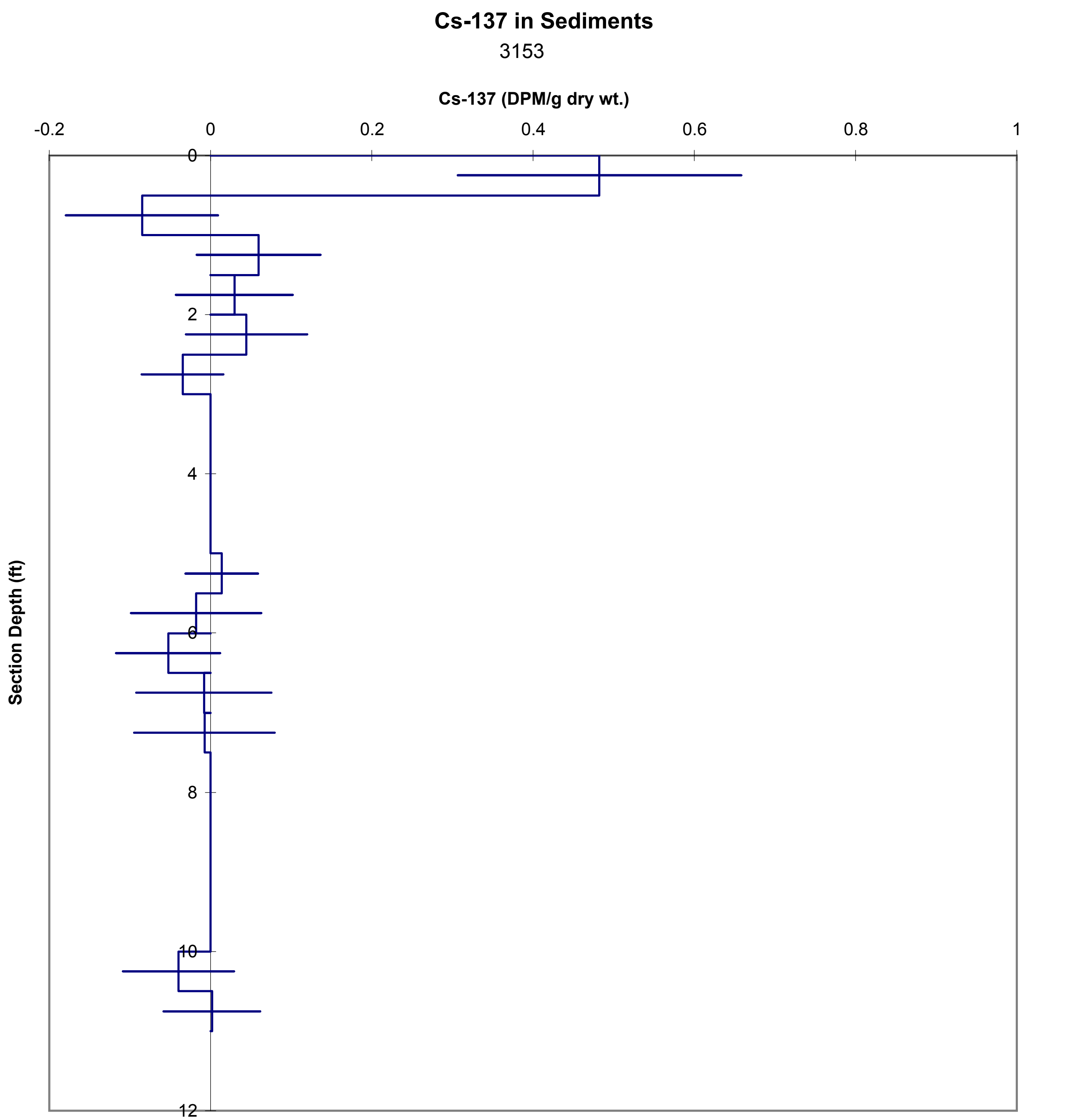
Section No.	Sample ID	Upper depth (cm)	Lower depth (cm)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	120704-SOI-03153-00.50	0	0.5	0.48	0.18
2	120704-SOI-03153-01.00	0.5	1	-0.08	0.09
3	120704-SOI-03153-01.50	1	1.5	0.06	0.08
4	120704-SOI-03153-02.00	1.5	2	0.03	0.07
5	120704-SOI-03153-02.50	2	2.5	0.04	0.08
6	120704-SOI-03153-03.00	2.5	3	-0.03	0.05
7	120704-SOI-03153-05.50	5	5.5	0.01	0.04
8	120704-SOI-03153-06.00	5.5	6	-0.02	0.08
9	120704-SOI-03153-06.50	6	6.5	-0.05	0.06
10	120704-SOI-03153-07.00	6.5	7	-0.01	0.08
11	120704-SOI-03153-07.50	7	7.5	-0.01	0.09
12	120704-SOI-03153-10.50	10	10.5	-0.04	0.07
13	120704-SOI-03153-11.00	10.5	11	0.00	0.06



Plot Table X Values	Plot Table Y Values
0	0
0.482184	0
0.482184	0.25
0.657986	0.25
0.306382	0.25
0.482184	0.25
0.482184	0.5
0	0.5
0	0.5
-0.08485	0.5
-0.08485	0.75
0.009479	0.75
-0.17918	0.75
-0.08485	0.75
-0.08485	1
0	1
0	1
0.059851	1
0.059851	1.25
0.136752	1.25
-0.01705	1.25
0.059851	1.25
0.059851	1.5
0	1.5
0	1.5
0.029548	1.5
0.029548	1.75
0.102142	1.75
-0.04305	1.75
0.029548	1.75
0.029548	2
0	2
0	2
0.044555	2
0.044555	2.25
0.119769	2.25
-0.03066	2.25
0.044555	2.25
0.044555	2.5
0	2.5
0	2.5
-0.03454	2.5
-0.03454	2.75
0.016206	2.75
-0.08529	2.75
-0.03454	2.75
-0.03454	3
0	3
0	5
0.014053	5
0.014053	5.25
0.058941	5.25
-0.03084	5.25
0.014053	5.25
0.014053	5.5
0	5.5
0	5.5
-0.01784	5.5
-0.01784	5.75
0.062699	5.75
-0.09838	5.75
-0.01784	5.75
-0.01784	6
0	6
0	6
-0.05253	6
-0.05253	6.25
0.011855	6.25
-0.11691	6.25
-0.05253	6.25
-0.05253	6.5
0	6.5
0	6.5
-0.00817	6.5
-0.00817	6.75
0.075502	6.75
-0.09184	6.75
-0.00817	6.75
-0.00817	7
0	7
0	7
-0.00748	7
-0.00748	7.25
0.079518	7.25
-0.09449	7.25
-0.00748	7.25
-0.00748	7.5
0	7.5
0	10
-0.03958	10
-0.03958	10.25
0.029282	10.25
-0.10845	10.25
-0.03958	10.25
-0.03958	10.5
0	10.5
0	10.5
0.001739	10.5
0.001739	10.75
0.061879	10.75
-0.0584	10.75
0.001739	10.75
0.001739	11
0	11

Core 3153

Herb Kelly
CH2M Hill
Gainesville, FL



Data Analysis by Flett Research Ltd.
440 DeSalaberry Ave.
Winnipeg, MB
Canada R2L 0Y7
(204) 667-2505

4/28/2005

Results of Pb-210 Analysis

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7
Fax/Phone (204) 667-2505
E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: **CH2M HILL - Herb Kelly**

Transaction ID:

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

PO/Contract No.: 905218

Core ID: 3153

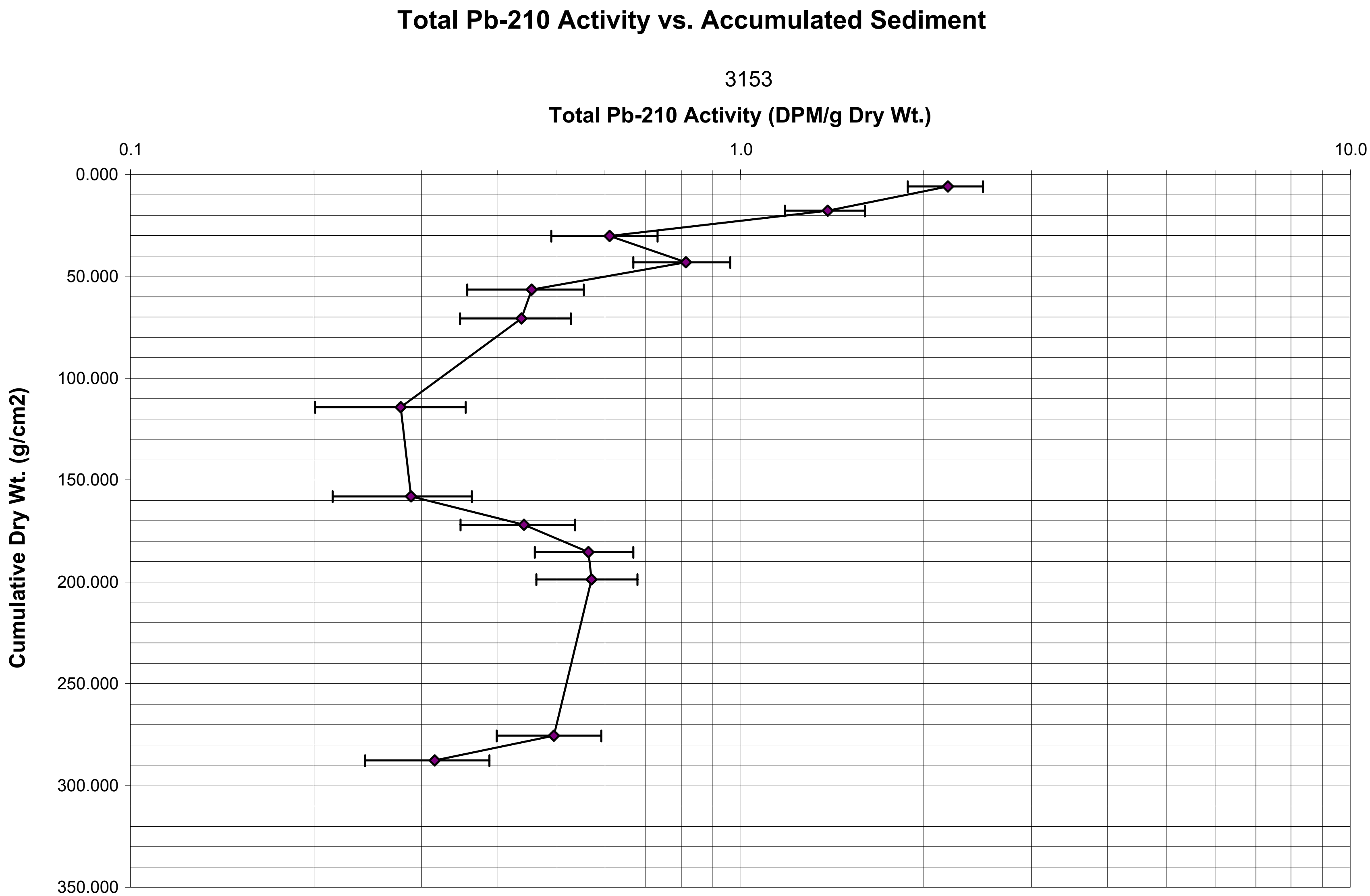
Date(s) Received: Feb. 8, 2005

Date(s) Analysed:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1	127259001	0.50	0.00	0.50	0.00	0.50	0.757	11.538	11.538	5.769	749	457	1.51	60000	2.19	0.31	1.58	34.2	0.50	0.3377
2	127259002	0.50	0.50	1.00	0.50	1.00	0.807	12.306	23.844	17.691	863	334	1.51	60000	1.39	0.21	0.78		1.00	
3	127259003	0.50	1.00	1.50	1.00	1.50	0.835	12.723	36.566	30.205	852	145	1.52	60000	0.61	0.12	0.00			
4	127259004	0.50	1.50	2.00	1.50	2.00	0.856	13.045	49.611	43.089	822	186	1.51	60000	0.81	0.15				
5	127259005	0.50	2.00	2.50	2.00	2.50	0.913	13.908	63.519	56.565	973	123	1.51	60000	0.46	0.10				
6	127259006	0.50	2.50	3.00	2.50	3.00	0.931	14.182	77.701	70.610	1086	132	1.51	60000	0.44	0.09				
7	127259007	0.50	3.00	5.50	3.00	5.50	0.958	72.988	150.690	114.196	934	72	1.51	60000	0.28	0.08				
8	127259008	0.50	5.50	6.00	5.50	6.00	0.948	14.445	165.135	157.912	1054	84	1.5	60000	0.29	0.07				
9	127259009	0.50	6.00	6.50	6.00	6.50	0.902	13.754	178.888	172.012	925	113	1.5	60000	0.44	0.09				
10	127259010	0.50	6.50	7.00	6.50	7.00	0.868	13.231	192.119	185.504	977	154	1.52	60000	0.56	0.10				
11	127259011	0.50	7.00	7.50	7.00	8.75	0.862	45.975	238.094	198.687	912	145	1.52	60000	0.57	0.11				
	127259012	0.50	10.00	10.50	8.75	10.50	0.817	43.569	281.663	275.439	1072	147	1.51	60000	0.50	0.10				
	127259013	0.50	10.50	11.00	10.50	11.00	0.799	12.177	293.840	287.752	1163	102	1.52	60000	0.32	0.07				
																Total Excess DPM in core =			27.84606485	
														Avg. BKG =	0.48			Avg. Sed. Rate =		0.3377

*: See 'Comments' section on 'Interpretation' sheet for discussior

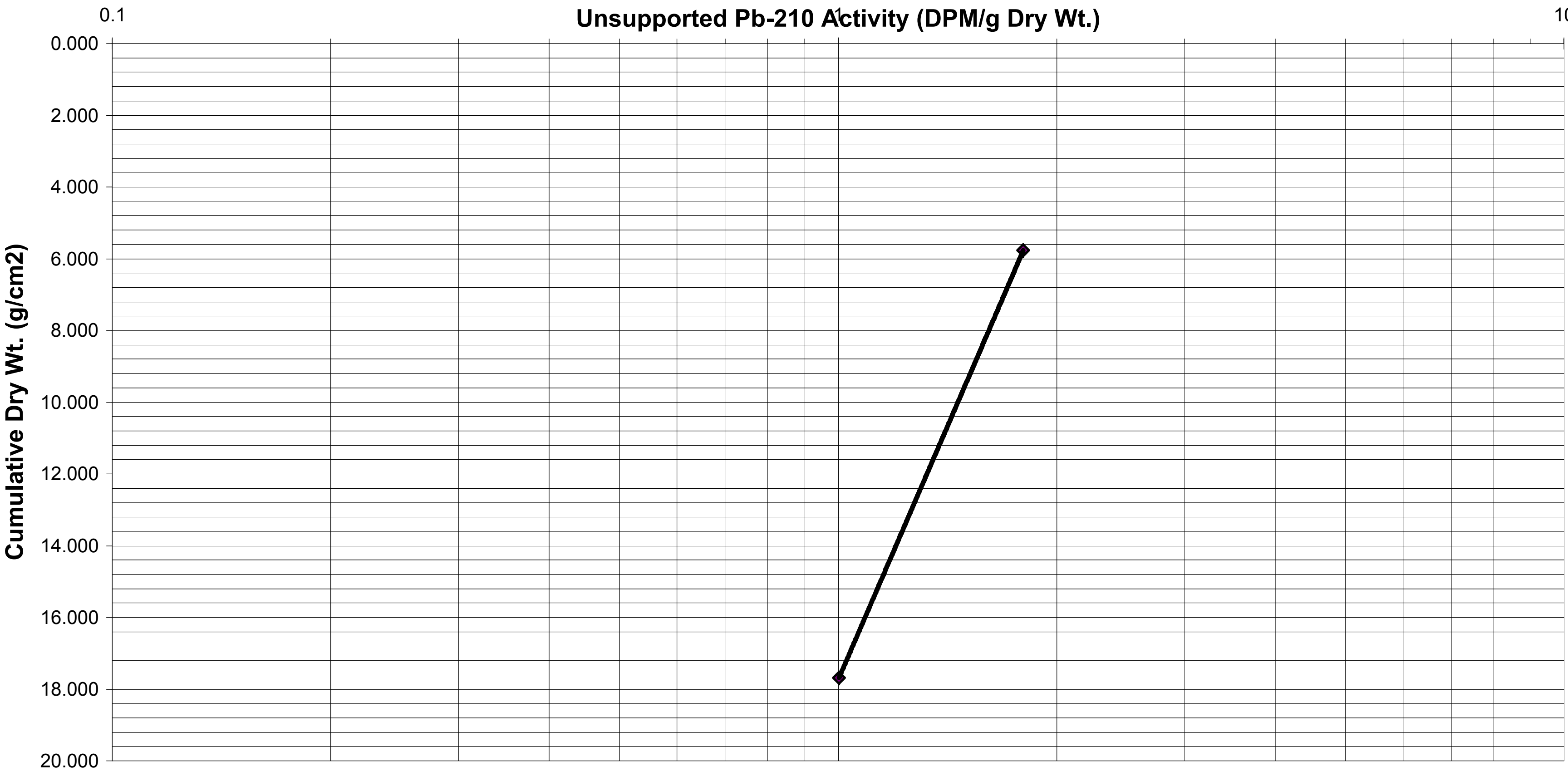

Total Pb-210 Activity vs. Accumulated Sediment
3153
Total Pb-210 Activity (DPM/g Dry Wt.)
0.1
1.0
10.0
0.000
50.000
100.000
150.000
200.000
250.000
300.000
350.000
Cumulative Dry Wt. (g/cm2)

r^2 fit as a function of background subtracted					
bkg (DPM/g)		r^2	Sediment Accumu-lation Rate ($g/cm^2/yr$)	Slope 'm'	Y inter-cept 'b'
0.0000		1.0000	0.8185	-26.33	26.40
0.0300		1.0000	0.8043	-25.88	25.69
0.0599		1.0000	0.7901	-25.42	24.98
0.0899		1.0000	0.7760	-24.97	24.28
0.1198		1.0000	0.7618	-24.51	23.59
0.1498		1.0000	0.7476	-24.05	22.91
0.1797		1.0000	0.7333	-23.59	22.23
0.2097		1.0000	0.7191	-23.14	21.57
0.2396		1.0000	0.7049	-22.68	20.91
0.2696		1.0000	0.6906	-22.22	20.26
0.2995		1.0000	0.6763	-21.76	19.61
0.3295		1.0000	0.6621	-21.30	18.98
0.3595		1.0000	0.6478	-20.84	18.36
0.3895		1.0000	0.6334	-20.38	17.74
0.4195		1.0000	0.6191	-19.92	17.14
0.4495		1.0000	0.6048	-19.46	16.54
0.4795		1.0000	0.5904	-18.99	15.96
0.5095		1.0000	0.5760	-18.53	15.38
0.5395		1.0000	0.5616	-18.07	14.81
0.5695		1.0000	0.5471	-17.60	14.26
0.5995		1.0000	0.5326	-17.14	13.71
Note: Used Column BM for Background Subtraction.					

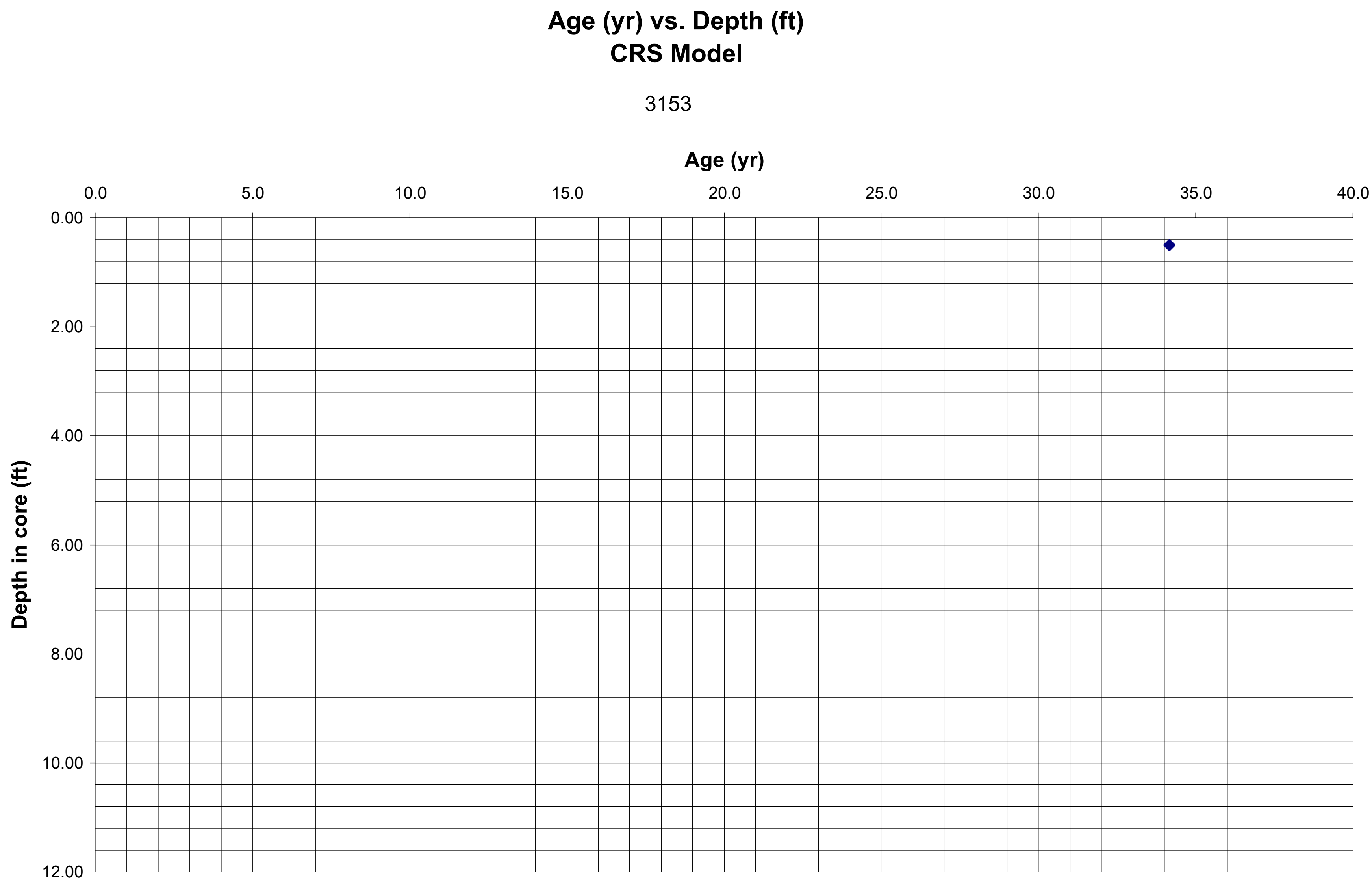
Note: this table presents results of Pb-210 linear regression model for a range of Pb-210 background activity levels. The model is applied assuming constant sediment accumulation rate. The model is used to generate 20 regressions using different values of background, across the possible range from zero activity to the lowest observed sample activity. The quality of the fit is an indication of the quality of the assumed background activities. The table above shows the R2 value obtained with each choice background, as well as the corresponding sediment accumulation rate, intercept and slope of the regression line.

Regression of Unsupported Pb-210 Activity vs. Accumulated Sediment Using Background = 0.4795 DPM/g

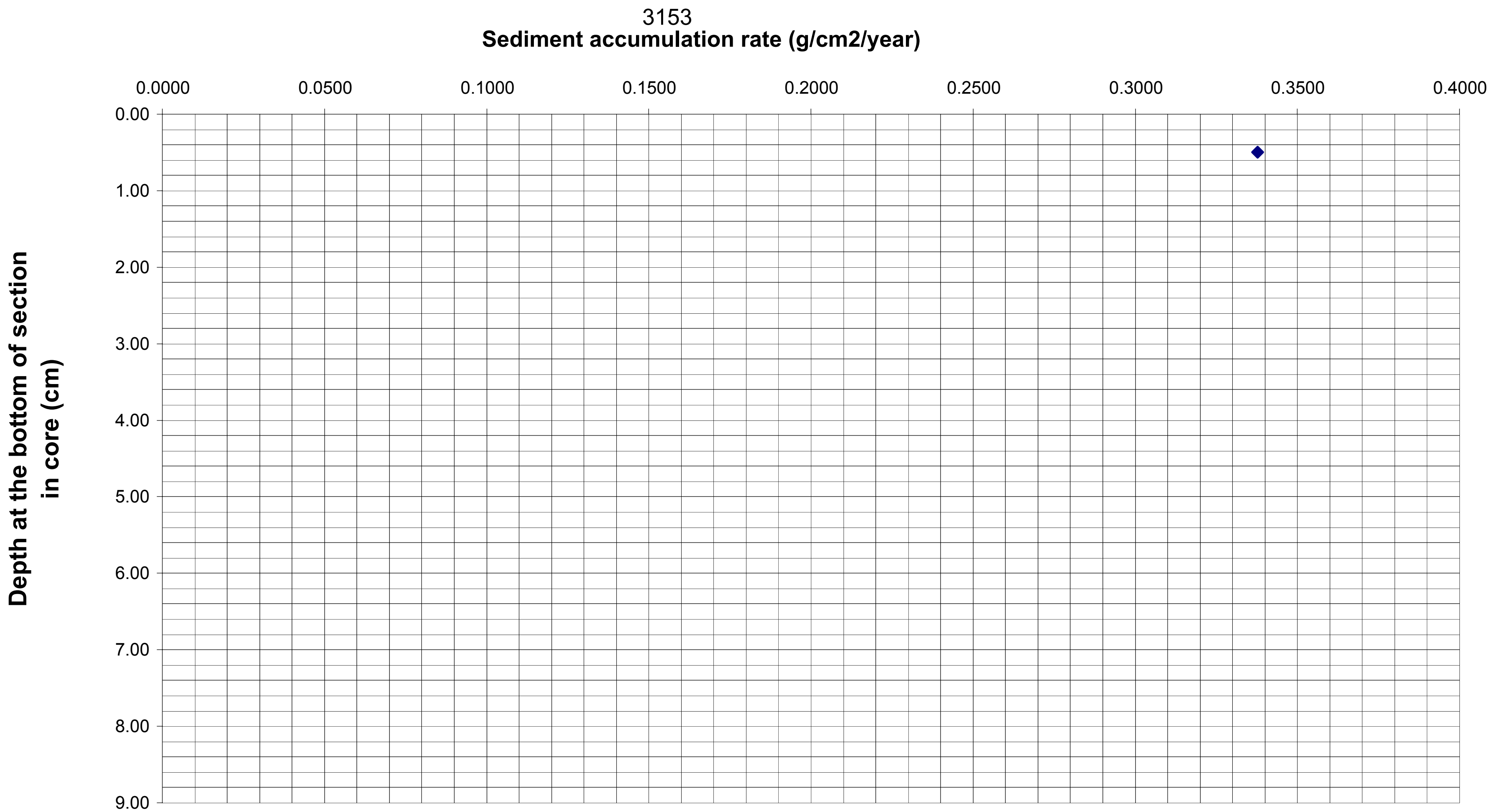
3153



$y = -20.381Ln(x) + 17.743$
$R^2 = 1$


Age (yr) vs. Depth (ft)
CRS Model
3153
Age (yr)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
Depth in core (ft)
0.00
2.00
4.00
6.00
8.00
10.00
12.00

CRS Sediment accumulation rate (g/cm2/year) vs Depth at the bottom of section in core (cm)



Radionuclide Results for Core 3154

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7

Fax/Phone (204) 667-2505

E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928

Transaction ID:

PO/Contract No.: 905218

Core ID: 3154

Date(s) Received: Feb 8, 2005

Date(s) Analysed:

Sampling Date(s):

Analyst(s):

Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

The profile of Pb-210 is essentially vertical in this core and it is impossible to apply the Pb-210 dating technique. The average activity of the Pb-210 is fairly low (about 0.74 DPM/g) and could be due solely to the presence of Ra-226 in the sediment.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

Conclusion:

Cs-137 is detected only in the top core section, indicating that the bottom edge of the section (at 0.5 ft depth) predates 1954, the year when significant fallout of atmospheric Cs-137 began. Based on this, the sediment accumulation rate is probably less than 0.5 ft / (2004 - 1954) = 0.010 ft/yr or 12.706 / 50 = 0.25 g/cm2/yr.

Results of Cs-137 Analysis

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7

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Client: **CH2M HILL - Herb Kelly**

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

Transaction ID:

PO/Contract No.: 905218

Core ID: 3154

Date(s) Received: Feb. 8, 2005

Sampling Date(s):

Project:

Date(s) Analysed:

Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
120804-SOI-03154-00.50	0	0.5	22	12	2004	48	16.43	3600	178			0.02176		0.243978	0.167055		GAMMA8
120804-SOI-03154-01.00	0.5	1	22	12	2004			3600	196					-0.033478	0.0619824		GAMMA12
120804-SOI-03154-01.50	1	1.5	22	12	2004			3600	167					-0.005748	0.0763236		GAMMA16
120804-SOI-03154-02.00	1.5	2	21	12	2004			3600	154					0.0489288	0.092685		GAMMA16
120804-SOI-03154-02.00(1272700			21	12	2004			3600	154					0.0111	0.061827		HP

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

Flett Research Ltd.
440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7
Fax/Phone (204) 667-2505
E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M Hill - Herb Kelly

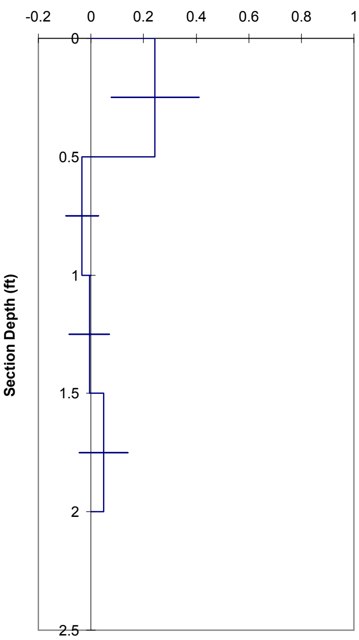
Core ID: 3154
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

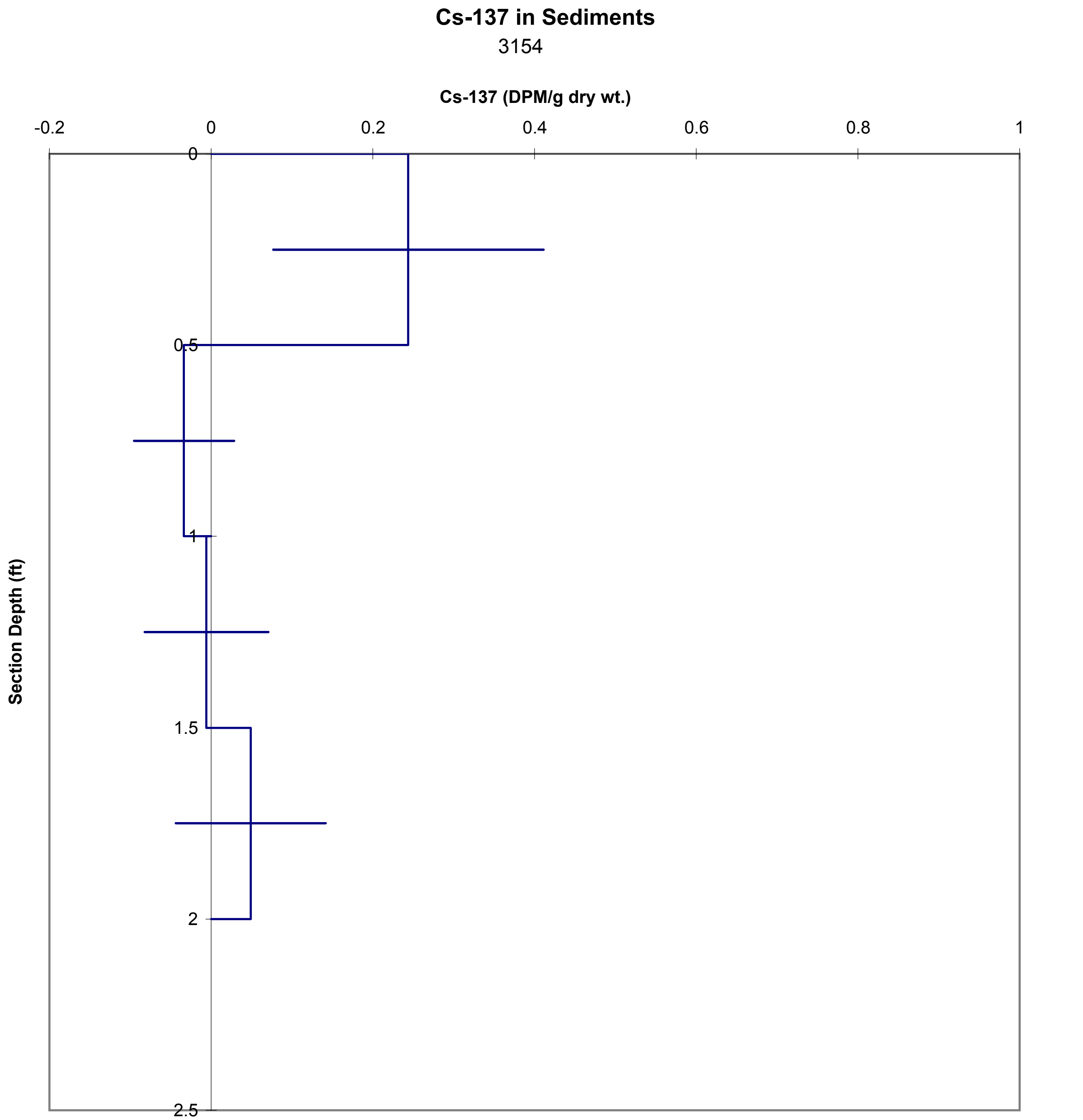
This table must remain open for chart to plot.

Section No.	Sample ID	Upper depth (cm)	Lower depth (cm)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	120804-SOI-03154-00.50	0	0.5	0.24	0.17
2	120804-SOI-03154-01.00	0.5	1	-0.03	0.06
3	120804-SOI-03154-01.50	1	1.5	-0.01	0.08
4	120804-SOI-03154-02.00	1.5	2	0.05	0.09



Plot Table X Values	Plot Table Y Values
0	0
0.243978	0
0.243978	0.25
0.411033	0.25
0.076923	0.25
0.243978	0.25
0.243978	0.5
0	0.5
0	0.5
-0.03348	0.5
-0.03348	0.75
0.028505	0.75
-0.09546	0.75
-0.03348	0.75
-0.03348	1
0	1
0	1
-0.00575	1
-0.00575	1.25
0.070576	1.25
-0.08207	1.25
-0.00575	1.25
-0.00575	1.5
0	1.5
0	1.5
0.048929	1.5
0.048929	1.75
0.141614	1.75
-0.04376	1.75
0.048929	1.75
0.048929	2
0	2

Herb Kelly
CH2M Hill
Gainesville, FL



Data Analysis by Flett Research Ltd.
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Canada R2L 0Y7
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4/28/2005

Results of Pb-210 Analysis

Flett Research Ltd.

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E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Delete extra charts AFTER printing!

Client: **CH2M HILL - Herb Kelly**

Transaction ID:

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

PO/Contract No.: 905218

Core ID: 3154

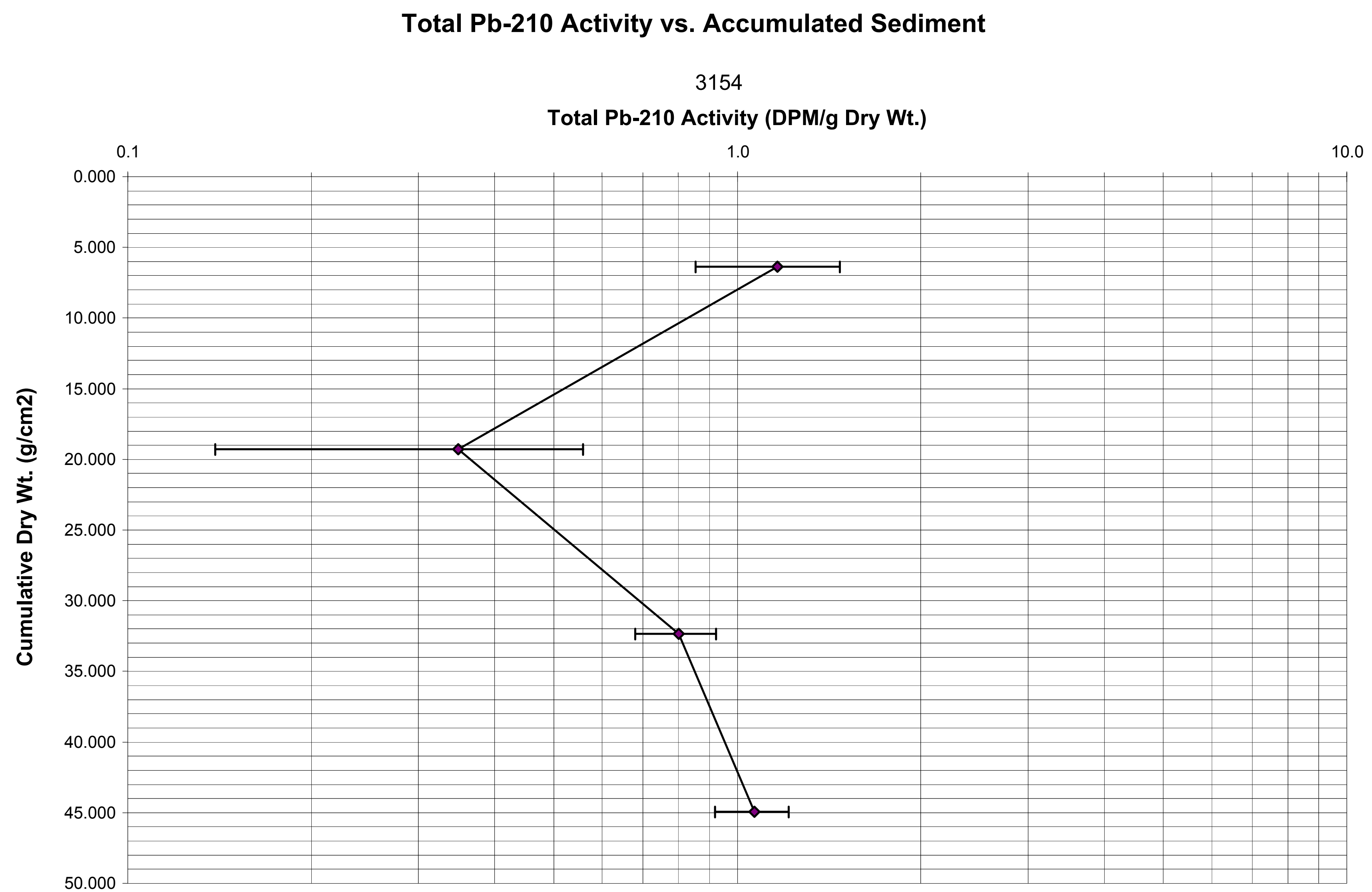
Date(s) Received: Feb. 8, 2005

Date(s) Analysed:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1		120804-SOI-03154-00.5C	127269018	0.50	0.00	0.50	0.0	0.5	0.833713	12.706	12.706	6.353	388.97	163.485	1.629	30300	1.16	0.31				
2		120804-SOI-03154-01.0C	127269019	0.50	0.50	1.00	0.5	1.0	0.864197	13.170	25.876	19.291	358.97	43.96	1.589	30300	0.35	0.21				
3		120804-SOI-03154-01.5C	127269020	0.50	1.00	1.50	1.0	1.5	0.846503	12.901	38.777	32.327	898	200	1.5	60000	0.80	0.12				
4		120804-SOI-03154-02.0C	127270001	0.50	1.50	2.00	1.5	2.0	0.809646	12.339	51.116	44.946	242.94	85.96	1.51	30300	1.07	0.15				
																		Total Excess DPM in core =			0	
																Avg. BKG =	0.74			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussion


Total Pb-210 Activity vs. Accumulated Sediment
3154
Total Pb-210 Activity (DPM/g Dry Wt.)
0.1
1.0
10.0
Cumulative Dry Wt. (g/cm2)
0.000
5.000
10.000
15.000
20.000
25.000
30.000
35.000
40.000
45.000
50.000

Radionuclide Results for Core 3155

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7

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E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928

Transaction ID:

PO/Contract No.: 905218

Core ID: 3155

Date(s) Received: Feb 8, 2005

Date(s) Analysed:

Sampling Date(s):

Analyst(s):

Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

The surface section (0 - 0.5 ft) has a Pb-210 activity of 3.6 DPM/g which is significantly above the average activity of 0.58 DPM/g seen in the bottom 5 sections. The 2nd section (0.5 - 1 ft) at 1.28 DPM/g may be above background also. Variation in the apparent background (0.34 - 0.85 DPM/g) makes it difficult to determine where background Pb-210 begins.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

The regression graph on Page 5 includes sections 1 - 2. It assumes constant input of Pb-210 and a constant rate of sediment accumulation. If one assumes that the average activity of the deepest 5 sections (0.58 DPM/g) is the true background, then the closest corresponding sediment accumulation rate in the R2 table on Page 4 (R2 = 1.000) is about 0.2578 g/cm2/yr . The Regression Plot, using 0.5711 DPM/g background, is seen on Page 5 above the R2 table on the EXCEL sheet. There are only 2 points available for this fit and therefore the R2 value is meaningless (always = 1.00). An age of 11.383 g/cm2 / 0.2578 g/cm2/yr = 44.2 yr can be calculated for the bottom of the top section, and an accumulation rate of 0.5 ft / 44.2 yr = 0.0113 ft/yr results.

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

The CRS model includes sections 1- 3. It assumes constant input of Pb-210 and a core that is long enough to include all of the measura atmospheric source Pb-210. If one assumes that the lowest measured activity in the modelled sections of the core (0.68 DPM/g) is the background Pb-210 level, then the CRS model can be applied. The results are shown in column Z of the main data table. An age of 53.9 years is determined for the bottom of the top section (0.5 ft depth) , corresponding to the year 1950 and a sediment accumulation rate of 0.2113 g/cm2/yr or 0.5 ft / 53.9 yr = 0.0093 ft/yr

Conclusion:

There is significant Cs-137 in the upper section (0.0 - 0.5 ft) and there may be some Cs-137 in section 2 (0.5 - 1.0 ft).For purposes of calculation, it is assumed that the bottom of section 1 is at 1958 and thus the majority of the Cs-137 has been captured in this section, and , that smaller amounts of the radionuclide, deposited from 1954 - 1958 may be present in section 2. If 1958 occurs at 0.5 ft, then a sediment accumulation rate can estimated to be 0.5 ft / (2004 - 1958) = 0.0109 ft/yr. [It is possible that section 2 contains no Cs-137 and therefore the sediment accumulation rate could be significantly lower]. This rate estimated by Cs-137 is similar to the 0.0093 ft /yr predicted by the CRS model and the 0.0113 ft/yr predicted by the regression model.

Results of Cs-137 Analysis

Flett Research Ltd.

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Client: **CH2M HILL - Herb Kelly**

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

Transaction ID:

PO/Contract No.: 905218

Core ID: 3155

Date(s) Received: Feb. 8, 2005

Date(s) Analysed:

Sampling Date(s):

Analyst(s):

Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
120904-SOI-03155-00.50	0	0.5	21	12	2004	113	15.44	3600	124			0.02051		0.870462	0.237984		GAMMA7
120904-SOI-03155-01.00	0.5	1	21	12	2004			3600	156					0.0999222	0.1094016		GAMMA8
120904-SOI-03155-01.50	1	1.5	21	12	2004			3600	173					-0.012912	0.0778998		GAMMA9
120904-SOI-03155-02.00	1.5	2	21	12	2004			3600	160					0.0456654	0.0576312		GAMMA10
120904-SOI-03155-02.50	2	2.5	21	12	2004			3600	169					0.0030392	0.0604284		GAMMA11
120904-SOI-03155-05.50	5	5.5	21	12	2004			3600	170					0	0.1554444		GAMMA12
120904-SOI-03155-06.00	5.5	6	21	12	2004			3600	164					0.0195848	0.072372		GAMMA16

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

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Client: CH2M Hill - Herb Kelly

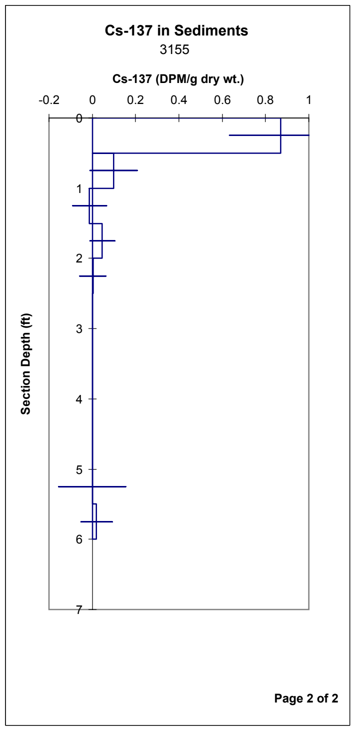
Core ID: 3155
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

This table must remain open for chart to plot.

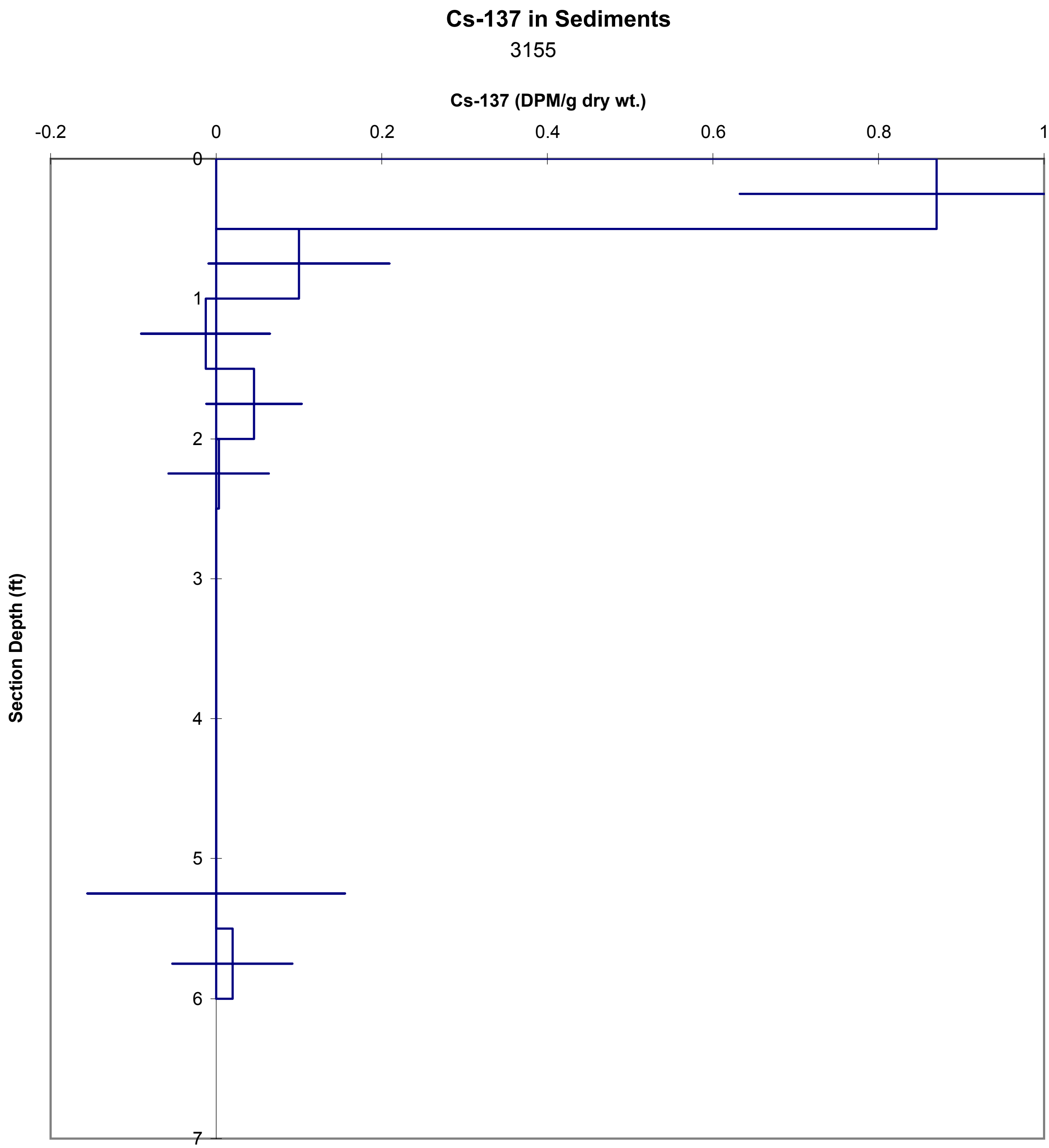
Results authorized by Dr. Robert J. Flett, Chief Scientist

Section No.	Sample ID	Upper depth (cm)	Lower depth (cm)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	120904-SOI-03155-00.50	0	0.5	0.87	0.24
2	120904-SOI-03155-01.00	0.5	1	0.10	0.11
3	120904-SOI-03155-01.50	1	1.5	-0.01	0.08
4	120904-SOI-03155-02.00	1.5	2	0.05	0.06
5	120904-SOI-03155-02.50	2	2.5	0.00	0.06
6	120904-SOI-03155-05.50	5	5.5	0.00	0.16
7	120904-SOI-03155-06.00	5.5	6	0.02	0.07



Plot Table X Values	Plot Table Y Values
0	0
0.870462	0
0.870462	0.25
1.108446	0.25
0.632478	0.25
0.870462	0.25
0.870462	0.5
0	0.5
0	0.5
0.099922	0.5
0.099922	0.75
0.209324	0.75
-0.00948	0.75
0.099922	0.75
0.099922	1
0	1
0	1
-0.01291	1
-0.01291	1.25
0.064988	1.25
-0.09081	1.25
-0.01291	1.25
-0.01291	1.5
0	1.5
0	1.5
0.045665	1.5
0.045665	1.75
0.103297	1.75
-0.01197	1.75
0.045665	1.75
0.045665	2
0	2
0	2
0.003039	2
0.003039	2.25
0.063468	2.25
-0.05739	2.25
0.003039	2.25
0.003039	2.5
0	2.5
0	5
0	5
0	5.25
0.155444	5.25
-0.15544	5.25
0	5.25
0	5.5
0	5.5
0	5.5
0.019585	5.5
0.019585	5.75
0.091957	5.75
-0.05279	5.75
0.019585	5.75
0.019585	6
0	6
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

Herb Kelly
CH2M Hill
Gainesville, FL



Data Analysis by Flett Research Ltd.
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4/28/2005

Results of Pb-210 Analysis

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Delete extra charts AFTER printing!

Client: **CH2M HILL - Herb Kelly**

Transaction ID:

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

PO/Contract No.: 905218

Core ID: 3155

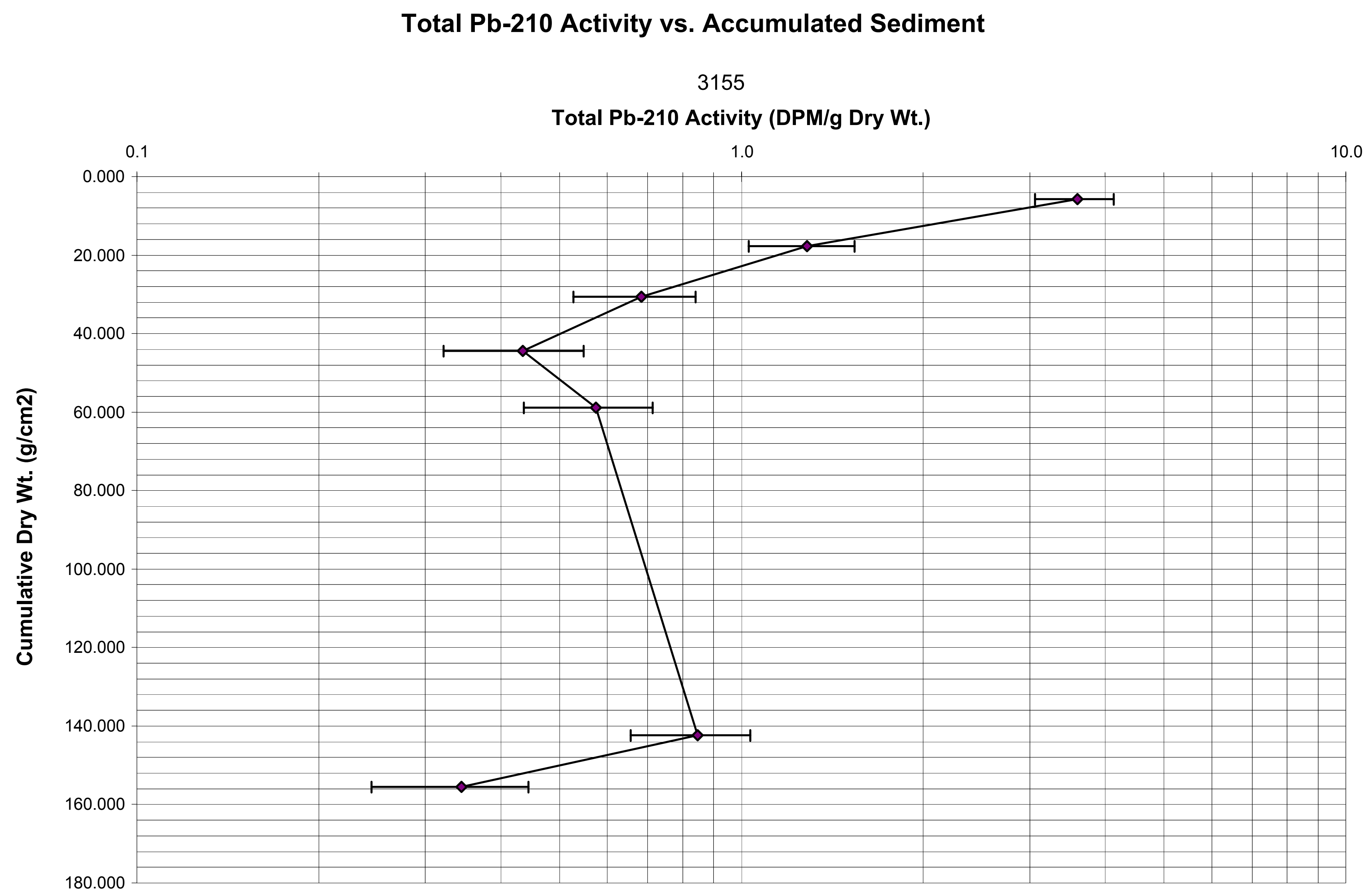
Date(s) Received: Feb. 8, 2005

Date(s) Analysed:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1		120904-SOI-03155-00.50	127270013	**0.50**	**0.00**	**0.50**	0.0	0.5	0.747	11.383	11.383	5.692	439.485	547.475	1.573	30300	**3.60**	**0.54**	2.92	**53.9**	0.5	0.2113
2		120904-SOI-03155-01.00	127270014	**0.50**	**0.50**	**1.00**	0.5	1.0	0.828	12.615	23.998	17.691	376.475	172.99	1.622	30300	**1.28**	**0.26**	0.60		1	
3		120904-SOI-03155-01.50	127270015	**0.50**	**1.00**	**1.50**	1.0	1.5	0.860	13.106	37.104	30.551	398.98	101.97	1.692	30300	**0.68**	**0.16**	0.00		1.5	
4		120904-SOI-03155-02.00	127270016	**0.50**	**1.50**	**2.00**	1.5	2.0	0.957	14.580	51.684	44.394	451.99	70.98	1.636	30300	**0.44**	**0.11**				
5		120904-SOI-03155-02.50	127270017	**0.50**	**2.00**	**2.50**	2.0	3.8	0.939	50.080	101.764	58.838	404.485	87.475	1.706	30300	**0.57**	**0.14**				
6		120904-SOI-03155-05.50	127270018	**0.50**	**5.00**	**5.50**	3.8	5.5	0.889	47.401	149.165	142.393	374.99	109.95	1.572	30300	**0.85**	**0.19**				
7		120904-SOI-03155-06.00	127270019	**0.50**	**5.50**	**6.00**	5.5	6.0	0.829	12.637	161.802	155.483	444.485	53.495	1.585	30300	**0.34**	**0.10**				
																		Total Excess DPM in core =			40.85616941	
																Avg. BKG =	**0.58**			Avg. Sed. Rate =		0.2113

*: See 'Comments' section on 'Interpretation' sheet for discussion

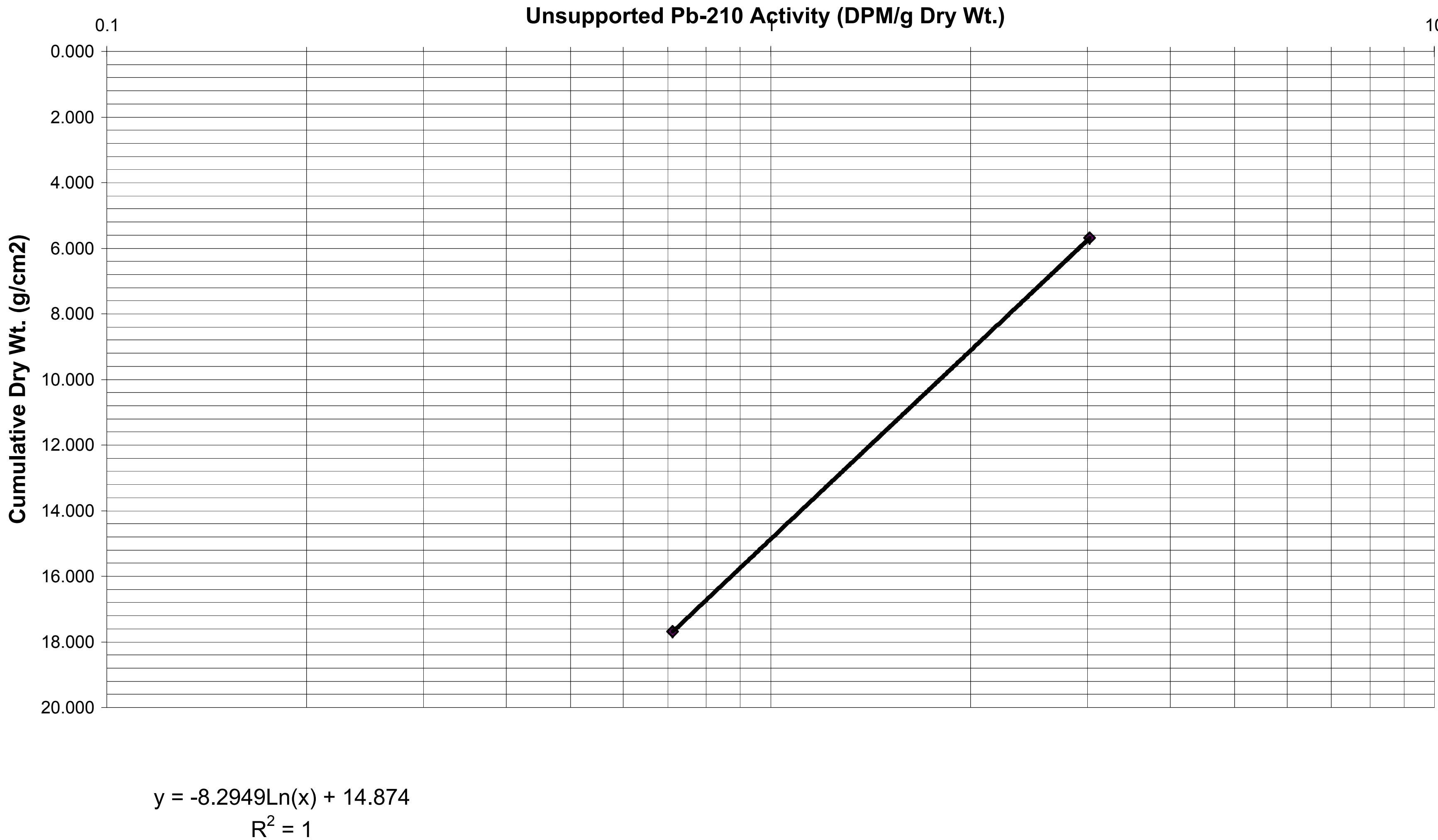

Total Pb-210 Activity vs. Accumulated Sediment
3155
Total Pb-210 Activity (DPM/g Dry Wt.)
0.1
1.0
10.0
0.000
20.000
40.000
60.000
80.000
100.000
120.000
140.000
160.000
180.000
Cumulative Dry Wt. (g/cm2)

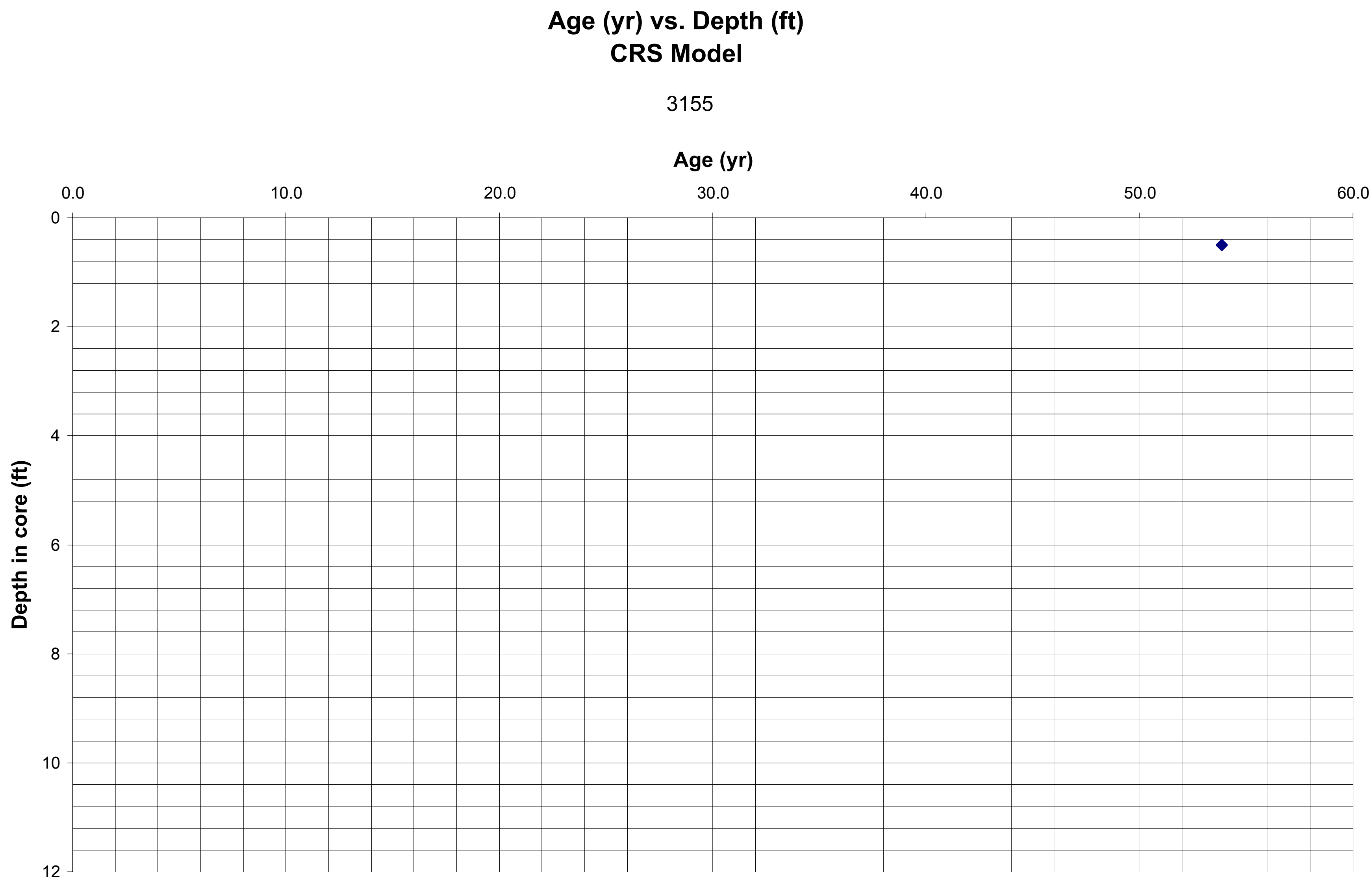
r^2 fit as a function of background subtracted					
bkg (DPM/g)		r^2	Sediment Accumu-lation Rate ($g/cm^2/yr$)	Slope 'm'	Y inter-cept 'b'
0.0000		1.0000	0.3619	-11.64	20.59
0.0635		1.0000	0.3507	-11.28	19.93
0.1269		1.0000	0.3394	-10.92	19.28
0.1904		1.0000	0.3281	-10.56	18.63
0.2538		1.0000	0.3166	-10.19	17.99
0.3173		1.0000	0.3051	-9.82	17.35
0.3807		1.0000	0.2935	-9.44	16.72
0.4442		1.0000	0.2817	-9.07	16.10
0.5076		1.0000	0.2699	-8.68	15.48
0.5711		1.0000	0.2578	-8.29	14.87
0.6345		1.0000	0.2456	-7.90	14.27
0.6980		1.0000	0.2331	-7.50	13.67
0.7615		1.0000	0.2203	-7.09	13.08
0.8250		1.0000	0.2072	-6.67	12.49
0.8885		1.0000	0.1937	-6.23	11.90
0.9520		1.0000	0.1796	-5.78	11.31
1.0155		1.0000	0.1646	-5.30	10.71
1.0790		1.0000	0.1486	-4.78	10.10
1.1425		1.0000	0.1306	-4.20	9.46
1.2060		1.0000	0.1088	-3.50	8.74
1.2695		1.0000	0.0731	-2.35	7.68
Note: Used Column BE for Background Subtraction.					

Note: this table presents results of Pb-210 linear regression model for a range of Pb-210 background activity levels. The model is applied assuming constant sediment accumulation rate. The model is used to generate 20 regressions using different values of background, across the possible range from zero activity to the lowest observed sample activity. The quality of the fit is an indication of the quality of the assumed background activities. The table above shows the R2 value obtained with each choice of background, as well as the corresponding sediment accumulation rate, intercept and slope of the regression line.

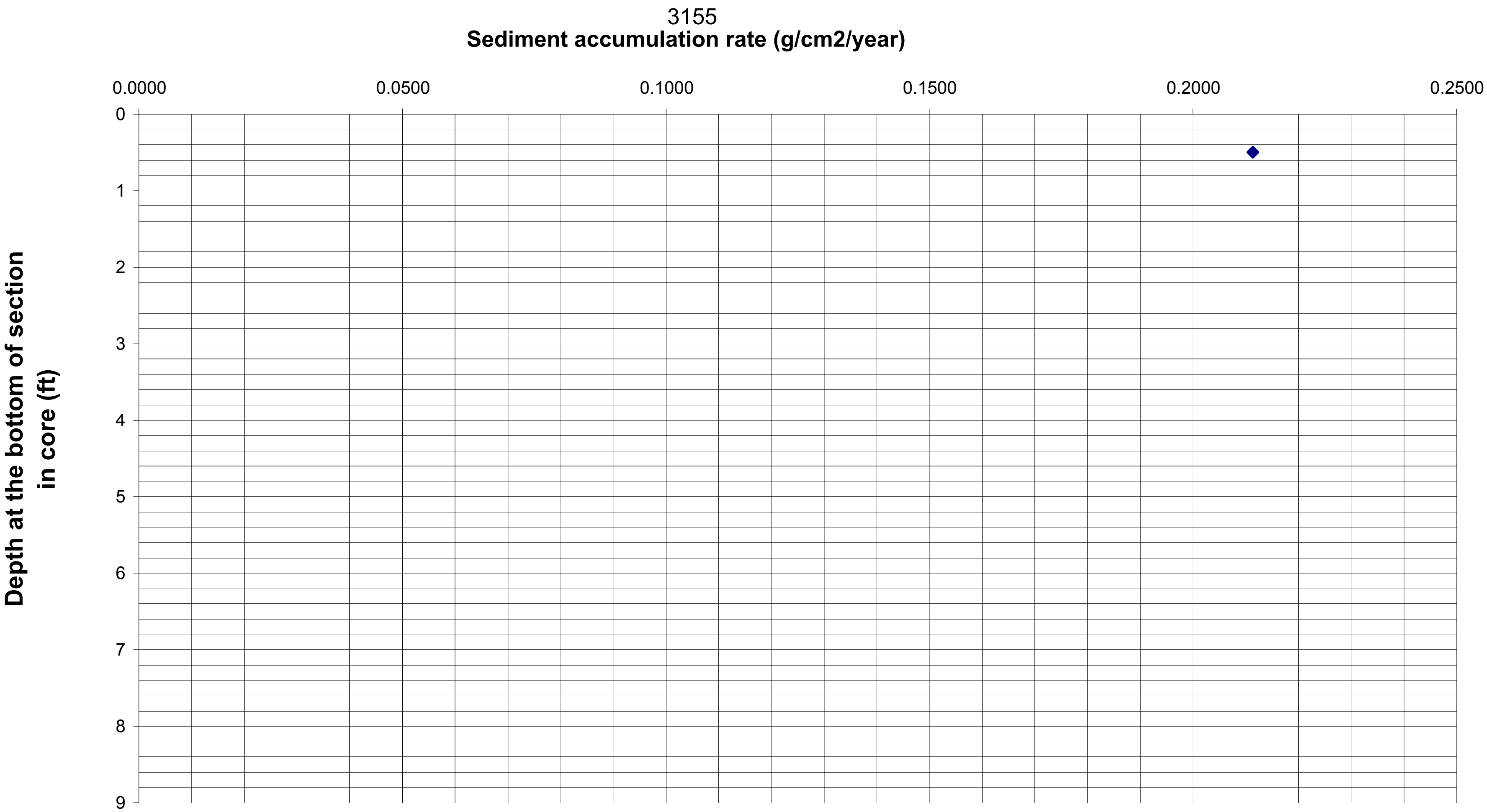
Regression of Unsupported Pb-210 Activity vs. Accumulated Sediment Using Background = 0.5711 DPM/g

3155




Age (yr) vs. Depth (ft)
CRS Model
3155
Age (yr)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Depth in core (ft)
0
2
4
6
8
10
12

CRS Sediment accumulation rate (g/cm2/year) vs Depth at the bottom of section in core (ft)



Radionuclide Results for Core 3156

Flett Research Ltd.

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Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928
Transaction ID:
PO/Contract No.: 905218

Core ID: 3156
Date(s) Received: Feb 8, 2005
Date(s) Analysed:
Sampling Date(s):
Analyst(s):
Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

Pb-210 appears to be above background only in the top section (0 - 0.5 ft) of the core (4.53 DPM/g). The deeper sections of the c (0.5 - 8.5 ft) are probably at background Pb-210 levels, with an average activity of 1.07 DPM/g and significant variation throughout the core. The Pb-210 models cannot be applied with only a single section showing excess Pb-210.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

Conclusion:

There is significant Cs-137 in the upper section (0.0 - 0.5 ft) and there may be some Cs-137 in section 2 (0.5 - 1.0 ft).For purposes calculation, it is assumed that the bottom of section 1 is at 1958 and thus the majority of the Cs-137 has been captured in this section, and , that smaller amounts of the radionuclide, deposited from 1954 - 1958 may be present in section 2. If 1958 occurs at ft, then a sediment accumulation rate can estimated to be 0.5 ft / (2004 - 1958) = 0.0109 ft/yr. It is possible that section 2 contains Cs-137 and therefore the sediment accumulation rate could be significantly lower.

Results of Cs-137 Analysis

Flett Research Ltd.

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Core ID: 3156
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
120904-SOI-03156-00.50	0	0.5	23	12	2004	133	18.77	3600	129			0.02077		0.974802	0.27528		GAMMA9
120904-SOI-03156-01.00	0.5	1	22	12	2004			3600	120					0.0563214	0.0978576		GAMMA8
120904-SOI-03156-01.50	1	1.5	22	12	2004			3600	142					-0.059296	0.1230546		GAMMA9
120904-SOI-03156-02.00	1.5	2	22	12	2004			3600	151					-0.049417	0.083805		GAMMA10
120904-SOI-03156-02.50	2	2.5	22	12	2004			3600	159					-0.042002	0.0730158		GAMMA12
120904-SOI-03156-03.00	2.5	3	22	12	2004			3600	155					0.0541902	0.0887556		GAMMA16
120904-SOI-03156-03.50	3	3.5	22	12	2004			3600	160					0.036519	0.0900654		GAMMA17
120904-SOI-03156-05.50	5	5.5	22	12	2004			3600	174					-0.009599	0.0402264		HP
120904-SOI-03156-06.00	5.5	6	23	12	2004			3600	178					0.0111511	0.050283		GAMMA1
120904-SOI-03156-06.50	6	6.5	23	12	2004			3600	177					-0.030791	0.0816072		GAMMA2
120904-SOI-03156-07.00	6.5	7	23	12	2004			3600	159					-0.036008	0.0773892		GAMMA3
120904-SOI-03156-07.50	7	7.5	23	12	2004			3600	169					-0.042646	0.0773448		GAMMA6
120904-SOI-03156-08.00	7.5	8	23	12	2004			3600	162					-0.040537	0.0717726		GAMMA7
120904-SOI-03156-08.50	8	8.5	23	12	2004			3600	167					0.0221378	0.0703962		GAMMA8

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

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Client: CH2M Hill - Herb Kelly

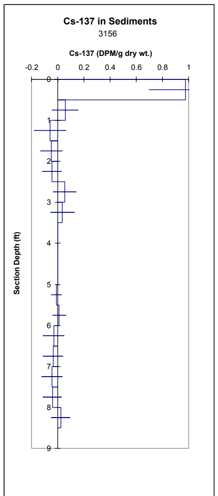
Core ID: 3156
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

This table must remain open for chart to plot.

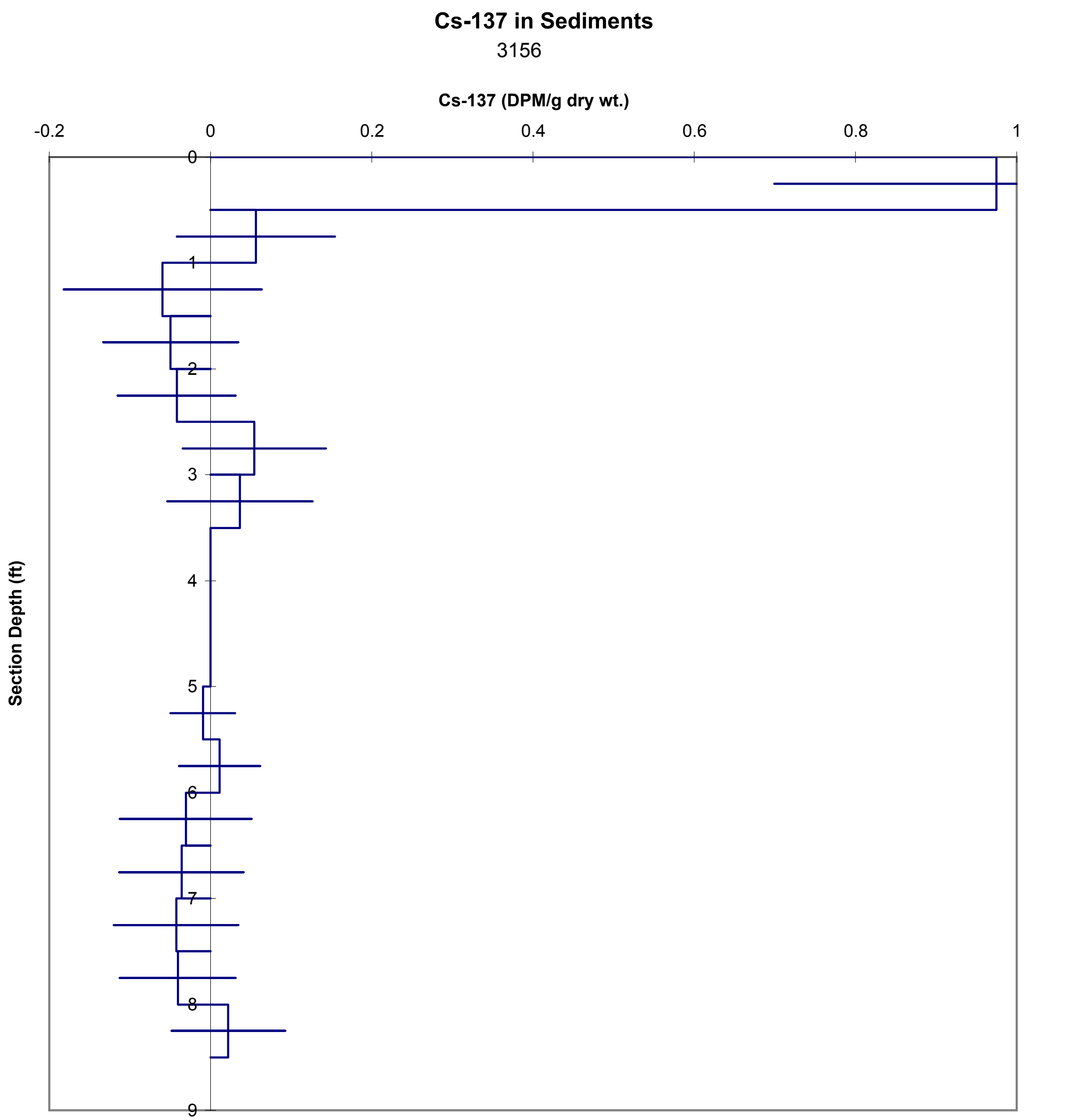
Section No.	Sample ID	Upper depth (ft)	Lower depth (ft)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	120904-SOI-03156-00.50	0	0.5	0.97	0.28
2	120904-SOI-03156-01.00	0.5	1	0.06	0.10
3	120904-SOI-03156-01.50	1	1.5	-0.06	0.12
4	120904-SOI-03156-02.00	1.5	2	-0.05	0.08
5	120904-SOI-03156-02.50	2	2.5	-0.04	0.07
6	120904-SOI-03156-03.00	2.5	3	0.05	0.09
7	120904-SOI-03156-03.50	3	3.5	0.04	0.09
8	120904-SOI-03156-05.50	5	5.5	-0.01	0.04
9	120904-SOI-03156-06.00	5.5	6	0.01	0.05
10	120904-SOI-03156-06.50	6	6.5	-0.03	0.08
11	120904-SOI-03156-07.00	6.5	7	-0.04	0.08
12	120904-SOI-03156-07.50	7	7.5	-0.04	0.08
13	120904-SOI-03156-08.00	7.5	8	-0.04	0.07
14	120904-SOI-03156-08.50	8	8.5	0.02	0.07



Page 2 of 2

Plot Table X Values	Plot Table Y Values
0	0
0.974802	0
0.974802	0.25
1.250082	0.25
0.699522	0.25
0.974802	0.25
0.974802	0.5
0	0.5
0	0.5
0.056321	0.5
0.056321	0.75
0.154179	0.75
-0.04154	0.75
0.056321	0.75
0.056321	1
0	1
0	1
-0.0593	1
-0.0593	1.25
0.063758	1.25
-0.18235	1.25
-0.0593	1.25
-0.0593	1.5
0	1.5
0	1.5
-0.04942	1.5
-0.04942	1.75
0.034388	1.75
-0.13322	1.75
-0.04942	1.75
-0.04942	2
0	2
0	2
-0.042	2
-0.042	2.25
0.031013	2.25
-0.11502	2.25
-0.042	2.25
-0.042	2.5
0	2.5
0	2.5
0.05419	2.5
0.05419	2.75
0.142946	2.75
-0.03457	2.75
0.05419	2.75
0.05419	3
0	3
0	3
0.036519	3
0.036519	3.25
0.126584	3.25
-0.05355	3.25
0.036519	3.25
0.036519	3.5
0	3.5
0	5
-0.0096	5
-0.0096	5.25
0.030627	5.25
-0.04983	5.25
-0.0096	5.25
-0.0096	5.5
0	5.5
0	5.5
0.011151	5.5
0.011151	5.75
0.061434	5.75
-0.03913	5.75
0.011151	5.75
0.011151	6
0	6
0	6
-0.03079	6
-0.03079	6.25
0.050816	6.25
-0.1124	6.25
-0.03079	6.25
-0.03079	6.5
0	6.5
0	6.5
-0.03601	6.5
-0.03601	6.75
0.041381	6.75
-0.1134	6.75
-0.03601	6.75
-0.03601	7
0	7
0	7
-0.04265	7
-0.04265	7.25
0.034699	7.25
-0.11999	7.25
-0.04265	7.25
-0.04265	7.5
0	7.5
0	7.5
-0.04054	7.5
-0.04054	7.75
0.031235	7.75
-0.11231	7.75
-0.04054	7.75
-0.04054	8
0	8
0	8
0.022138	8
0.022138	8.25
0.092534	8.25
-0.04826	8.25
0.022138	8.25
0.022138	8.5
0	8.5

Herb Kelly
CH2M Hill
Gainesville, FL



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4/28/2005

Results of Pb-210 Analysis

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Client: **CH2M HILL - Herb Kelly** **Transaction ID:**

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

PO/Contract No.: 905218

Core ID: 3156

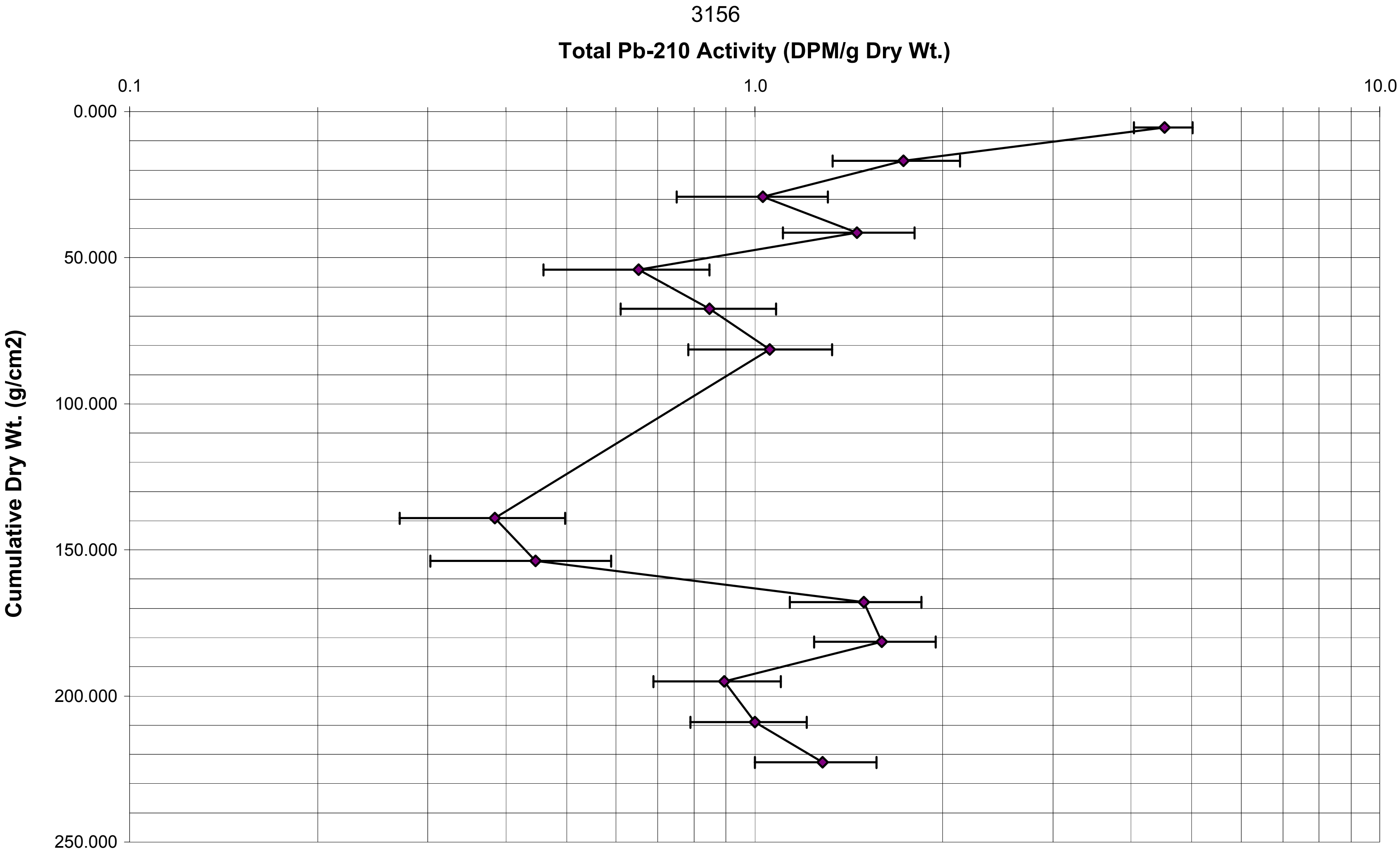
Date(s) Received: Feb. 8, 2005 **Date(s) Analysed:**

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate (g/cm^2/yr)
1		120904-SOI-03156-00.5(	127395020	**0.50**	**0.00**	**0.50**	0.00	0.50	0.705557	10.753	10.753	5.376	805	1008	1.503	60000	**4.53**	**0.49**	3.46			
2		120904-SOI-03156-01.0(	127399003	**0.50**	**0.50**	**1.00**	0.50	1.00	0.798484	12.169	22.922	16.837	228.425	135.96	1.589	30300	**1.73**	**0.40**				
3		120904-SOI-03156-01.5(	127399004	**0.50**	**1.00**	**1.50**	1.00	1.50	0.803485	12.245	35.167	29.044	239.445	85.425	1.602	30300	**1.03**	**0.28**				
4		120904-SOI-03156-02.0(	127399005	**0.50**	**1.50**	**2.00**	1.50	2.00	0.81078	12.356	47.523	41.345	235.445	122.435	1.651	30300	**1.46**	**0.35**				
5		120904-SOI-03156-02.5(	127399006	**0.50**	**2.00**	**2.50**	2.00	2.50	0.862264	13.141	60.664	54.093	269.96	63.455	1.664	30300	**0.65**	**0.19**				
6		120904-SOI-03156-03.0(	127399007	**0.50**	**2.50**	**3.00**	2.50	3.00	0.886955	13.517	74.181	67.422	244.97	75.455	1.682	30300	**0.85**	**0.24**				
7		120904-SOI-03156-03.5(	127399008	**0.50**	**3.00**	**3.50**	3.00	4.25	0.939635	35.800	109.981	81.341	257.95	89.96	1.526	30300	**1.06**	**0.27**				
8		120904-SOI-03156-05.5(	127399009	**0.50**	**5.00**	**5.50**	4.25	5.50	0.953915	36.344	146.325	139.056	441.93	55.98	1.524	30300	**0.38**	**0.11**				
9		120904-SOI-03156-06.0(	127399010	**0.50**	**5.50**	**6.00**	5.50	6.00	0.967162	14.740	161.065	153.695	376.87	56.89	1.566	30300	**0.45**	**0.14**				
10		120904-SOI-03156-06.5(	127399011	**0.50**	**6.00**	**6.50**	6.00	6.50	0.901916	13.745	174.810	167.937	239.98	118.95	1.534	30300	**1.49**	**0.36**				
11		120904-SOI-03156-07.0(	127399012	**0.50**	**6.50**	**7.00**	6.50	7.00	0.876204	13.353	188.163	181.487	267.82	152.445	1.648	30300	**1.60**	**0.35**				
12		120904-SOI-03156-07.5(	127399013	**0.50**	**7.00**	**7.50**	7.00	7.50	0.901148	13.733	201.897	195.030	380.98	110.95	1.506	30300	**0.89**	**0.21**				
13		120904-SOI-03156-08.0(	127399014	**0.50**	**7.50**	**8.00**	7.50	8.00	0.912102	13.900	215.797	208.847	390.97	142.96	1.689	30300	**1.00**	**0.21**				
14		120904-SOI-03156-08.5(	127399015	**0.50**	**8.00**	**8.50**	8.00	8.50	0.909271	13.857	229.655	222.726	306.98	142.92	1.677	30300	**1.28**	**0.28**				
																		Total Excess DPM in core =			#VALUE!	
																Avg. BKG =	**1.07**			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussion

Total Pb-210 Activity vs. Accumulated Sediment



Radionuclide Results for Core 3157

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7

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E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928
Transaction ID:
PO/Contract No.: 905218

Core ID: 3157
Date(s) Received: Feb 8, 2005
Date(s) Analysed:
Sampling Date(s):
Analyst(s):
Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

Pb-210 appears to be above background only in the top section (0 - 0.5 ft) of the core (2.21 DPM/g). The deeper sections of the c (0.5 - 6.5 ft) are probably at background Pb-210 levels, with an average activity of 1.26 DPM/g and significant variation throughout the core. The Pb-210 models cannot be applied with only a single section showing excess Pb-210.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

Conclusion:

Cs-137 is detected only in the top core section, indicating that the bottom edge of the section (at 0.5 ft depth) predates 1954, the year when significant fallout of atmospheric Cs-137 began. Based on this, the sediment accumulation rate is probably less than 0. / (2004 - 1954) = 0.010 ft/yr or 12.342 / 50 = 0.25 g/cm2/yr.

Results of Cs-137 Analysis

Flett Research Ltd.

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PO/Contract No.: 905218

Core ID: 3157
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
120904-SOI-03157-00.50	0	0.5	21	12	2004	105	13.3	3600	167			0.03615		0.341658	0.0866022		GAMMA18
120904-SOI-03157-01.00	0.5	1	21	12	2004			7200	167					0.0009875	0.1527582		WELL
120904-SOI-03157-01.50	1	1.5	21	12	2004			3600	162					0.0198868	0.074037		GAMMA3
120904-SOI-03157-02.00	1.5	2	21	12	2004			3600	146					-0.027572	0.0849816		GAMMA11
120904-SOI-03157-02.50	2	2.5	21	12	2004			3600	148					-0.085181	0.0908646		GAMMA10
120904-SOI-03157-03.00	2.5	3	21	12	2004			3600	147					-0.039694	0.1020756		GAMMA17
120904-SOI-03157-03.50	3	3.5	21	12	2004			3600	112					-0.07921	0.1118658		GAMMA1
120904-SOI-03157-05.50	5	5.5	21	12	2004			3600	165					0.0679542	0.0812742		GAMMA2
120904-SOI-03157-06.00	5.5	6	21	12	2004			3600	141					0.025974	0.0854034		GAMMA3
120904-SOI-03157-06.50	6	6.5	21	12	2004			3600	154					0.0130625	0.0818958		GAMMA4
120904-SOI-03157-07.00	6.5	7	21	12	2004			3600	137					0.0058253	0.112665		GAMMA6

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

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Client: CH2M Hill - Herb Kelly

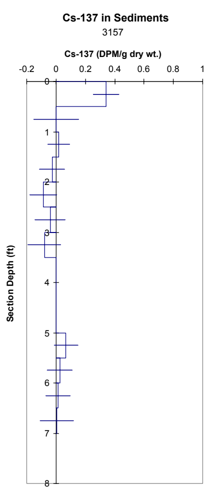
Core ID: 3157
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

This table must remain open for chart to plot.

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section No.	Sample ID	Upper depth (ft)	Lower depth (ft)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	120904-SOI-03157-00.50	0	0.5	0.34	0.09
2	120904-SOI-03157-01.00	0.5	1	0.00	0.15
3	120904-SOI-03157-01.50	1	1.5	0.02	0.07
4	120904-SOI-03157-02.00	1.5	2	-0.03	0.08
5	120904-SOI-03157-02.50	2	2.5	-0.09	0.09
6	120904-SOI-03157-03.00	2.5	3	-0.04	0.10
7	120904-SOI-03157-03.50	3	3.5	-0.08	0.11
8	120904-SOI-03157-05.50	5	5.5	0.07	0.08
9	120904-SOI-03157-06.00	5.5	6	0.03	0.09
10	120904-SOI-03157-06.50	6	6.5	0.01	0.08
11	120904-SOI-03157-07.00	6.5	7	0.01	0.11

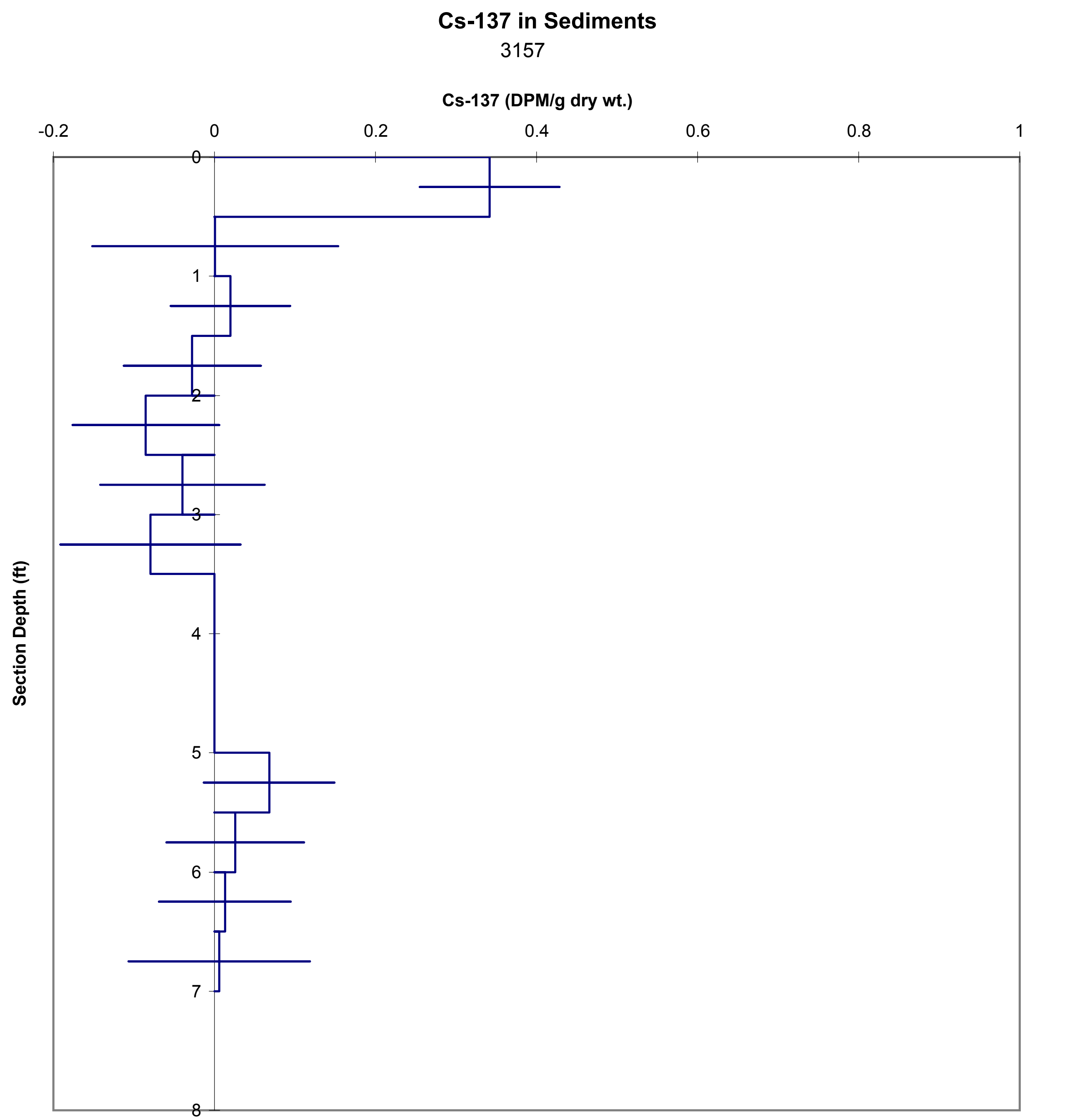


Page 2 of 2

Plot Table X Values	Plot Table Y Values
0	0
0.34166	0
0.34166	0.25
0.42826	0.25
0.25506	0.25
0.34166	0.25
0.34166	0.5
0	0.5
0	0.5
0.00099	0.5
0.00099	0.75
0.15375	0.75
-0.15177	0.75
0.00099	0.75
0.00099	1
0	1
0	1
0.01989	1
0.01989	1.25
0.09392	1.25
-0.05415	1.25
0.01989	1.25
0.01989	1.5
0	1.5
0	1.5
-0.02757	1.5
-0.02757	1.75
0.05741	1.75
-0.11255	1.75
-0.02757	1.75
-0.02757	2
0	2
0	2
-0.08518	2
-0.08518	2.25
0.00568	2.25
-0.17605	2.25
-0.08518	2.25
-0.08518	2.5
0	2.5
0	2.5
-0.03969	2.5
-0.03969	2.75
0.06238	2.75
-0.14177	2.75
-0.03969	2.75
-0.03969	3
0	3
0	3
-0.07921	3
-0.07921	3.25
0.03266	3.25
-0.19108	3.25
-0.07921	3.25
-0.07921	3.5
0	3.5
0	5
0.06795	5
0.06795	5.25
0.14923	5.25
-0.01332	5.25
0.06795	5.25
0.06795	5.5
0	5.5
0	5.5
0.02597	5.5
0.02597	5.75
0.11138	5.75
-0.05943	5.75
0.02597	5.75
0.02597	6
0	6
0	6
0.01306	6
0.01306	6.25
0.09496	6.25
-0.06883	6.25
0.01306	6.25
0.01306	6.5
0	6.5
0	6.5
0.00583	6.5
0.00583	6.75
0.11849	6.75
-0.10684	6.75
0.00583	6.75
0.00583	7
0	7

Core 3157

Herb Kelly
CH2M Hill
Gainesville, FL



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Results of Pb-210 Analysis

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Client: **CH2M HILL - Herb Kelly** **Transaction ID:**

Address: 3011 S.W. Williston Road **PO/Contract No.:** 905218

Gainesville, FL 32608-3928

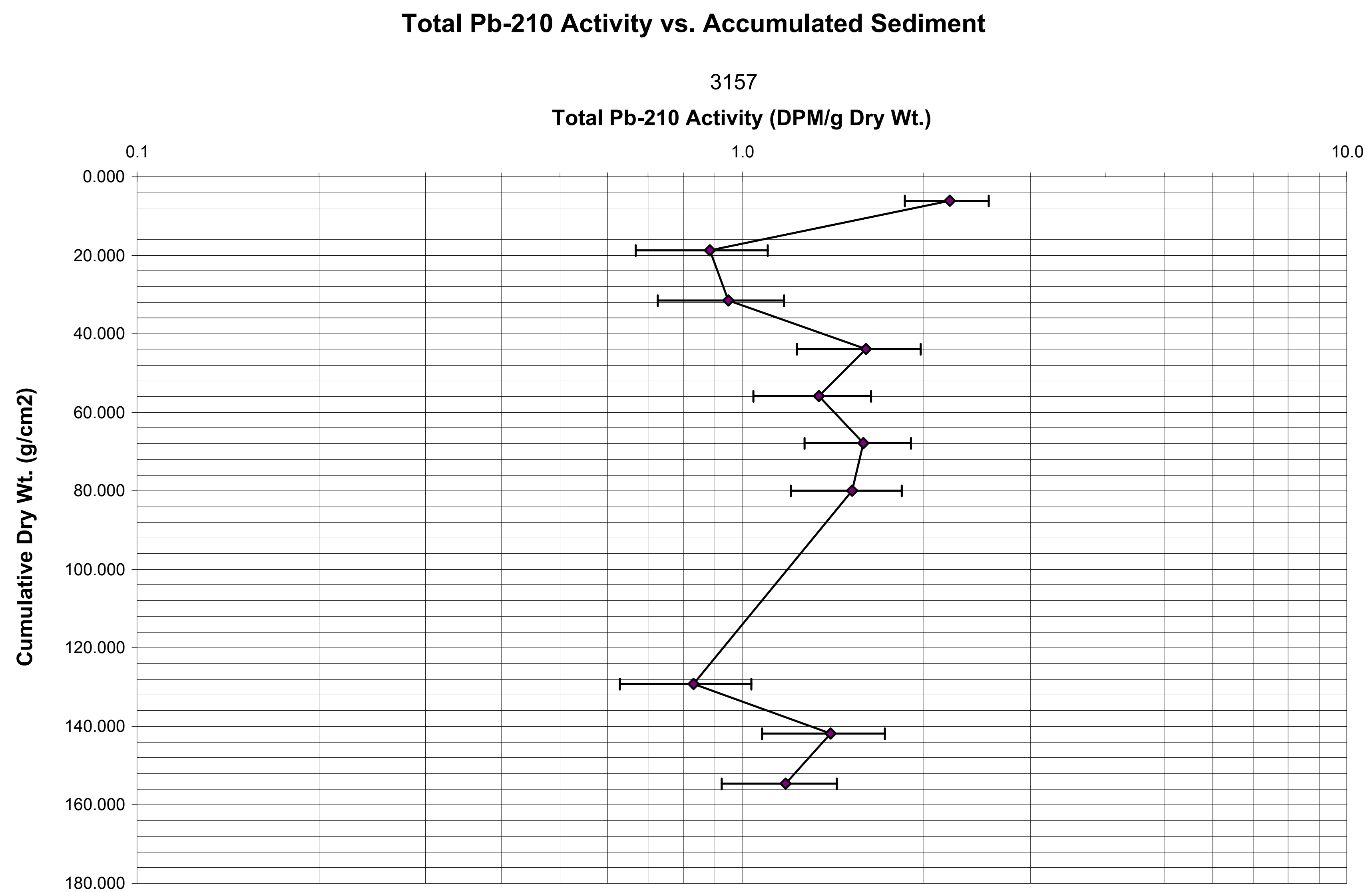
Core ID: 3157

Date(s) Received: Feb. 8, 2005 **Date(s) Analysed:**

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1		120904-SOI-03157-00.5C	127270002	**0.50**	**0.00**	**0.50**	0.00	0.50	0.809852	12.342	12.342	6.171	403.98	310.475	1.576	30300	**2.21**	**0.35**	0.95			
2		120904-SOI-03157-01.0C	127270003	**0.50**	**0.50**	**1.00**	0.50	1.00	0.842054	12.833	25.175	18.759	287.475	90.97	1.618	30300	**0.89**	**0.22**				
3		120904-SOI-03157-01.5C	127270004	**0.50**	**1.00**	**1.50**	1.00	1.50	0.833903	12.709	37.884	31.529	320.94	104.99	1.559	30300	**0.95**	**0.22**				
4		120904-SOI-03157-02.0C	127270005	**0.50**	**1.50**	**2.00**	1.50	2.00	0.783465	11.940	49.824	43.854	236.475	129.97	1.553	30300	**1.60**	**0.37**				
5		120904-SOI-03157-02.5C	127270006	**0.50**	**2.00**	**2.50**	2.00	2.50	0.78933	12.029	61.853	55.838	294.97	133	1.523	30300	**1.34**	**0.30**				
6		120904-SOI-03157-03.0C	127270007	**0.50**	**2.50**	**3.00**	2.50	3.00	0.796399	12.137	73.990	67.922	330.485	180.475	1.559	30300	**1.59**	**0.32**				
7		120904-SOI-03157-03.5C	127270008	**0.50**	**3.00**	**3.50**	3.00	4.25	0.790607	30.122	104.112	80.015	310.465	161.495	1.55	30300	**1.52**	**0.32**				
8		120904-SOI-03157-05.5C	127270009	**0.50**	**5.00**	**5.50**	4.25	5.50	0.824124	31.399	135.512	129.232	341.98	94.98	1.51	30300	**0.83**	**0.20**				
9		120904-SOI-03157-06.0C	127270010	**0.50**	**5.50**	**6.00**	5.50	6.00	0.832217	12.683	148.194	141.853	255.475	126.99	1.606	30300	**1.40**	**0.32**				
10		120904-SOI-03157-06.5C	127270011	**0.50**	**6.00**	**6.50**	6.00	6.50	0.84038	12.807	161.002	154.598	340.455	136.485	1.538	30300	**1.18**	**0.26**				
																		Total Excess DPM in core =			#VALUE!	
																Avg. BKG =	**1.26**			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussion



Total Pb-210 Activity vs. Accumulated Sediment
3157
Total Pb-210 Activity (DPM/g Dry Wt.)
0.1
1.0
10.0
Cumulative Dry Wt. (g/cm2)
0.000
20.000
40.000
60.000
80.000
100.000
120.000
140.000
160.000
180.000

Radionuclide Results for Core 3158

Flett Research Ltd.

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Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928

Transaction ID:

PO/Contract No.: 905218

Core ID: 3158

Date(s) Received: Feb 8, 2005

Date(s) Analysed:

Sampling Date(s):

Analyst(s):

Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

There is an approximately exponential drop in the Pb-210 activity as a function of depth in the core (Pages 2 & 3) and background activity does not appear to have been reached. The surface activity of 1.54 DPM/g is ~ 4 times the lowest Pb-210 level of 0.41 DPM/g seen in section 4.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2)

The regression graph on Page 5 includes sections 1 - 4. The model assumes constant input of Pb-210 and a constant rate of sediment accumulation. The best regression fit (R2 = 0.9876) occurs when a background of 0.2995 DPM/g is chosen, and the corresponding sediment accumulation rate is 0.5203 g/cm2/yr (R2 Table on Page 4). The age of the bottom of section 1 can be calculated as 11.926 g/cm2 / 0.5203 g/cm2/yr = 22.9 yr. This is equivalent to a sediment accumulation rate of 0.5 ft / 22.9 yr = 0.022 ft/yr.

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

The CRS model cannot be applied because background Pb-210 levels have not been achieved in the core.

Conclusion:

Cs-137 is detected only in the top core section, indicating that the bottom edge of the section (at 0.5 ft depth) predates 1954, the year when significant fallout of atmospheric Cs-137 began. Based on this, the sediment accumulation rate is probably less than 0.5 ft / (2004 - 1954) = 0.010 ft/yr or 11.926 / 50 = 0.24 g/cm2/yr. In contrast, the Pb-210 regression method predicts an age of only 22.9 yr at 0.5 ft. and a sediment accumulation rate of 0.022 ft/yr or 0.52 g/cm2/yr. I suggest that the Cs-137 data be relied upon because it is possible that the Pb-210 profile is actually due to background Ra-226 that decreases downward in the core, and is not due to atmospheric source Pb-210. In other words, the Pb-210 profile may simply have been an artifact.

Results of Cs-137 Analysis

Flett Research Ltd.

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Core ID: 3158
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Transaction ID:
PO/Contract No.: 905218

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
120904-SOI-03158-00.50	0	0.5	23	12	2004	320	35.31	14400	140			0.02163		0.518592	0.1145076		GAMMA1
120904-SOI-03158-01.00	0.5	1	22	12	2004			3600	168					0.0213031	0.0761682		GAMMA17
120904-SOI-03158-01.50	1	1.5	22	12	2004			3600	188					0.0137995	0.0494394		HP
120904-SOI-03158-02.00	1.5	2	22	12	2004			3600	178					0.0168542	0.0548784		GAMMA1

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

Flett Research Ltd.
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Client: CH2M Hill - Herb Kelly

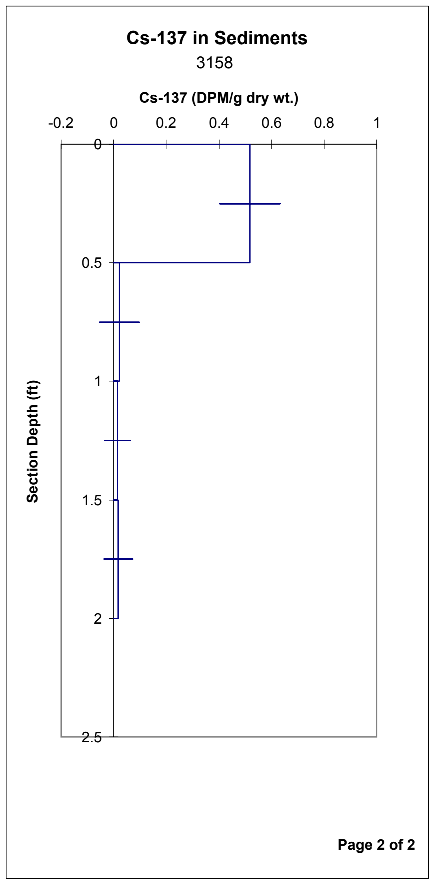
Core ID: 3158
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

This table must remain open for chart to plot.

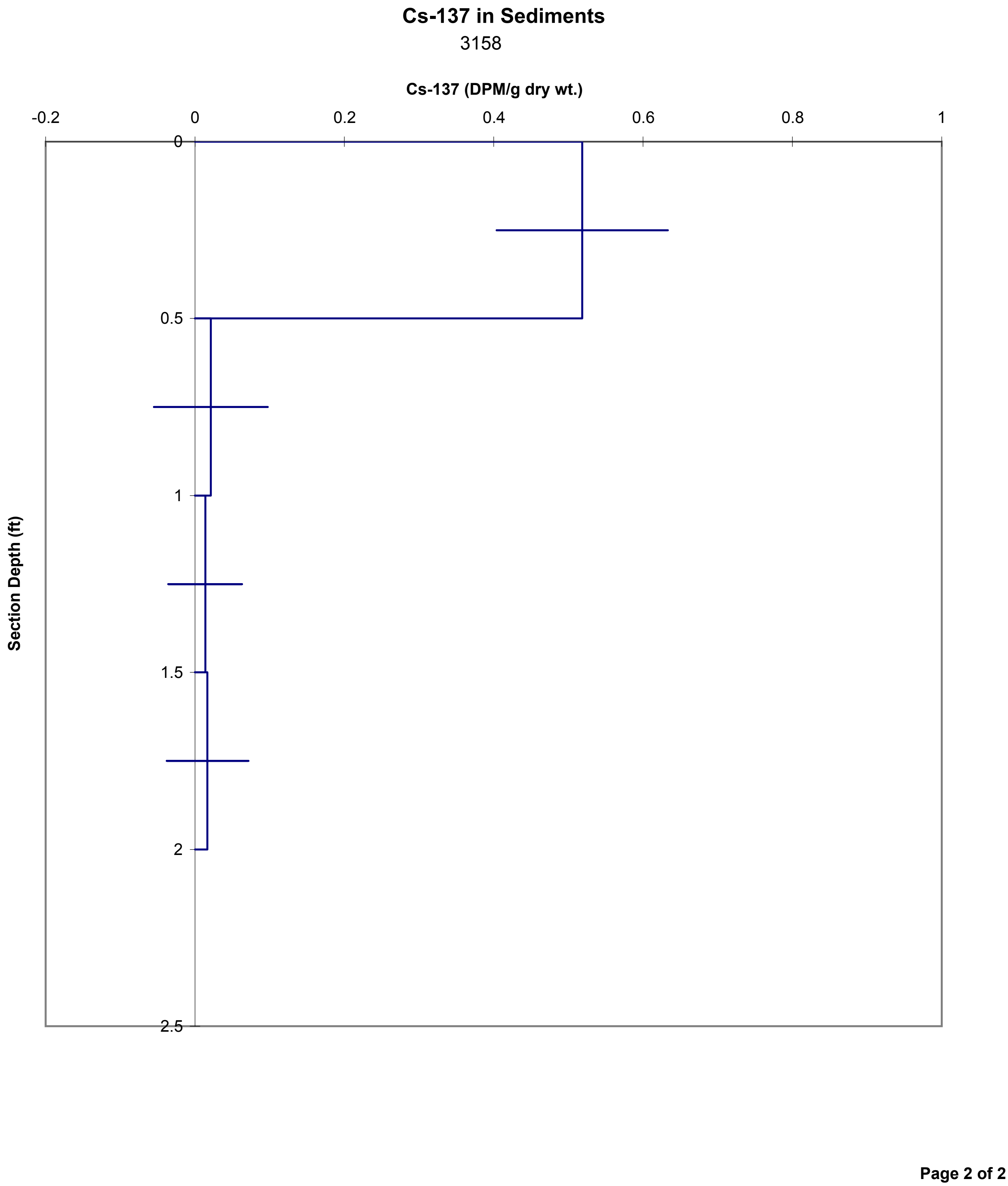
Results authorized by Dr. Robert J. Flett, Chief Scientist

Section No.	Sample ID	Upper depth (ft)	Lower depth (ft)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	120904-SOI-03158-00.50	0	0.5	0.52	0.11
2	120904-SOI-03158-01.00	0.5	1	0.02	0.08
3	120904-SOI-03158-01.50	1	1.5	0.01	0.05
4	120904-SOI-03158-02.00	1.5	2	0.02	0.05



Plot Table X Values	Plot Table Y Values
0	0
0.518592	0
0.518592	0.25
0.6331	0.25
0.404084	0.25
0.518592	0.25
0.518592	0.5
0	0.5
0	0.5
0.021303	0.5
0.021303	0.75
0.097471	0.75
-0.05487	0.75
0.021303	0.75
0.021303	1
0	1
0	1
0.0138	1
0.0138	1.25
0.063239	1.25
-0.03564	1.25
0.0138	1.25
0.0138	1.5
0	1.5
0	1.5
0.016854	1.5
0.016854	1.75
0.071733	1.75
-0.03802	1.75
0.016854	1.75
0.016854	2
0	2

Herb Kelly
CH2M Hill
Gainesville, FL



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(204) 667-2505

4/28/2005

Results of Pb-210 Analysis

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Client: **CH2M HILL - Herb Kelly**

Transaction ID:

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

PO/Contract No.: 905218

Core ID: 3158

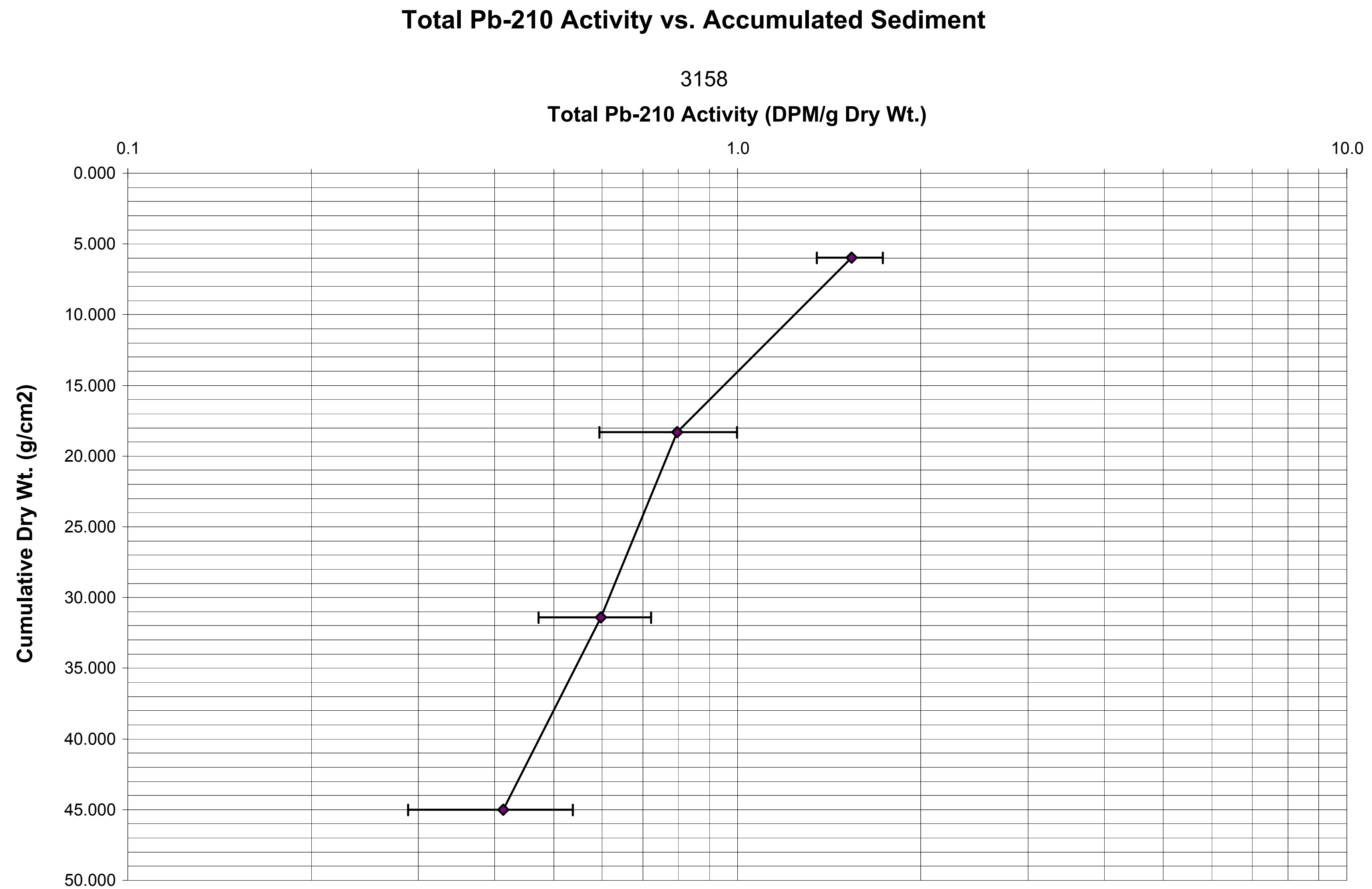
Date(s) Received: Feb. 8, 2005

Date(s) Analysed:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1		120904-SOI-03158-00.5C	127271011	**0.50**	**0.00**	**0.50**	0.00	0.50	0.783	11.926	11.926	5.963	1032	444	1.502	60000	**1.54**	**0.19**				
2		120904-SOI-03158-01.0C	127271012	**0.50**	**0.50**	**1.00**	0.50	1.00	0.839	12.791	24.716	18.321	309.95	88.475	1.609	30300	**0.80**	**0.20**				
3		120904-SOI-03158-01.5C	127271013	**0.50**	**1.00**	**1.50**	1.00	1.50	0.876	13.354	38.071	31.394	719	120	1.5	60000	**0.60**	**0.13**				
4		120904-SOI-03158-02.0C	127271014	**0.50**	**1.50**	**2.00**	1.50	2.00	0.912	13.895	51.965	45.018	404.485	61.92	1.63	30300	**0.41**	**0.12**				
																		Total Excess DPM in core =			0	
																Avg. BKG =	**0.60**			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussion


Total Pb-210 Activity vs. Accumulated Sediment
3158
Total Pb-210 Activity (DPM/g Dry Wt.)
0.1
1.0
10.0
Cumulative Dry Wt. (g/cm2)
0.000
5.000
10.000
15.000
20.000
25.000
30.000
35.000
40.000
45.000
50.000

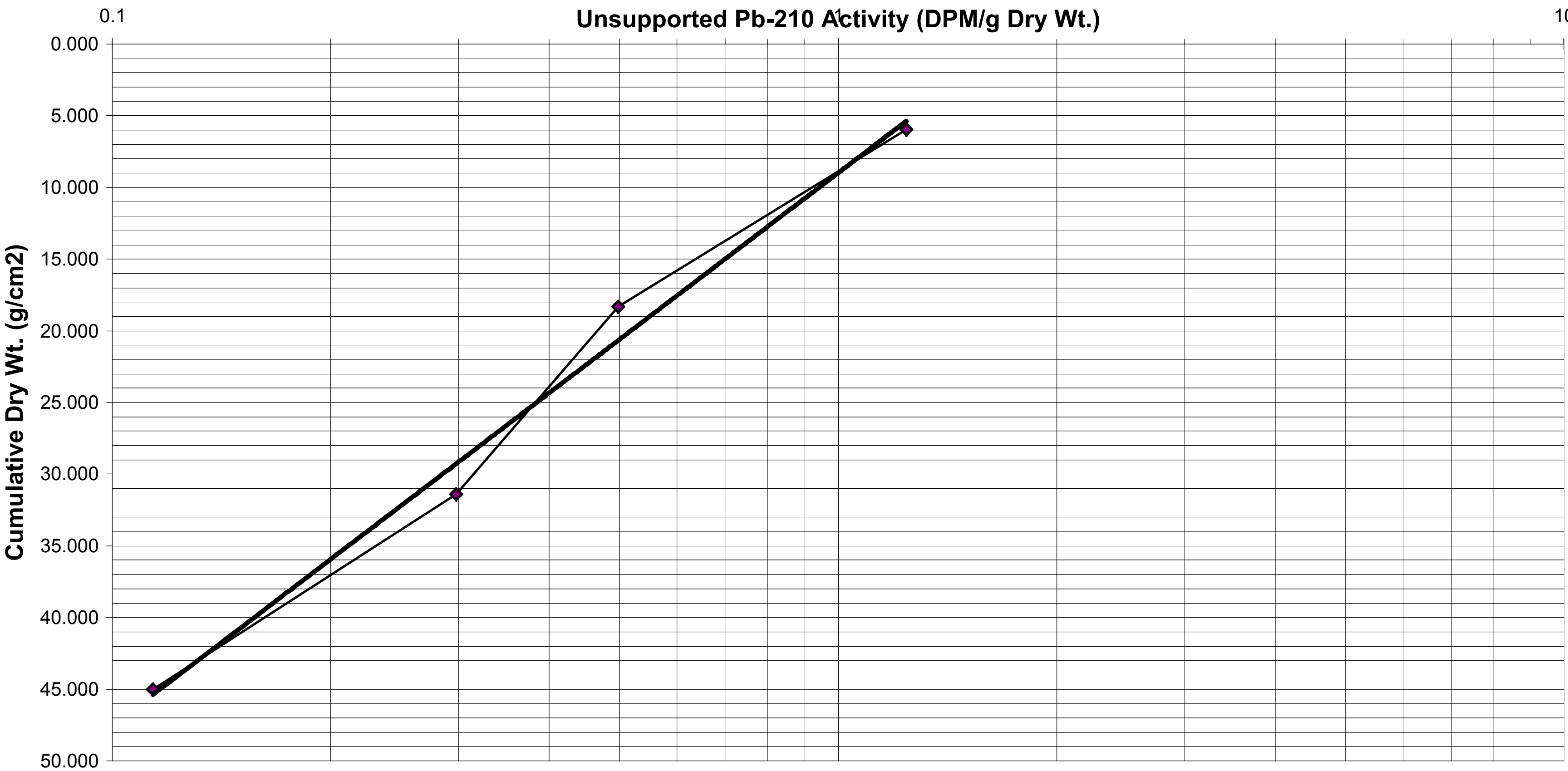
r^2 fit as a function of background subtracted					
bkg (DPM/g)		r^2	Sediment Accumu-lation Rate ($g/cm^2/yr$)	Slope 'm'	Y inter-cept 'b'
0.0000		0.9593	0.9197	-29.59	16.34
0.0200		0.9612	0.8965	-28.84	15.68
0.0399		0.9632	0.8730	-28.09	15.04
0.0599		0.9653	0.8493	-27.33	14.42
0.0798		0.9674	0.8252	-26.55	13.81
0.0998		0.9696	0.8009	-25.77	13.23
0.1197		0.9718	0.7761	-24.97	12.66
0.1397		0.9741	0.7509	-24.16	12.12
0.1596		0.9763	0.7252	-23.33	11.60
0.1796		0.9785	0.6989	-22.49	11.11
0.1995		0.9807	0.6719	-21.62	10.65
0.2195		0.9828	0.6441	-20.72	10.22
0.2395		0.9847	0.6153	-19.80	9.83
0.2595		0.9862	0.5853	-18.83	9.49
0.2795		0.9873	0.5538	-17.82	9.21
0.2995		0.9876	0.5203	-16.74	8.99
0.3195		0.9865	0.4842	-15.58	8.87
0.3395		0.9832	0.4445	-14.30	8.87
0.3595		0.9759	0.3993	-12.85	9.06
0.3795		0.9606	0.3445	-11.08	9.57
0.3995		0.9236	0.2673	-8.60	10.81
Note: Used Column BQ for Background Subtraction.					

0

Note: this table presents results of Pb-210 linear regression model for a range of Pb-210 background activity levels. The model is applied assuming constant sediment accumulation rate. The model is used to generate 20 regressions using different values of background, across the possible range from zero activity to the lowest observed sample activity. The quality of the fit is an indication of the quality of the assumed background activities. The table above shows the R2 value obtained with each choice (background, as well as the corresponding sediment accumulation rate, intercept and slope of the regression line.

Regression of Unsupported Pb-210 Activity vs. Accumulated Sediment Using Background = 0.2995 DPM/g

3158



$y = -16.741\mathrm{Ln}(x) + 8.9909$

$R^2 = 0.9876$

Radionuclide Results for Core 3159

Flett Research Ltd.

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Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928
Transaction ID:
PO/Contract No.: 905218

Core ID: 3159
Date(s) Received: Feb 8, 2005
Date(s) Analysed:
Sampling Date(s):
Analyst(s):
Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

Pb-210 appears to be above background only in the top section (0 - 0.5 ft) of the core (3.86 DPM/g). The deeper sections of the c (0.5 - 7.5 ft) are probably at background Pb-210 levels, with an average activity of 1.62 DPM/g and significant variation throughout the core. The Pb-210 models cannot be applied with only a single section showing excess Pb-210.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

Conclusion:

Cs-137 is detected only in the top core section, indicating that the bottom edge of the section (at 0.5 ft depth) predates 1954, the year when significant fallout of atmospheric Cs-137 began. Based on this, the sediment accumulation rate is probably less than 0. / (2004 - 1954) = 0.010 ft/yr or 11.257 / 50 = 0.225 g/cm2/yr.

Results of Cs-137 Analysis

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Date(s) Received: Feb. 8, 2005
Sampling Date(s):
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Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
120904-SOI-03159-00.50	0	0.5	21	12	2004	67	11.78	3600	126			0.01742		0.599622	0.2108778		GAMMA17
120904-SOI-03159-01.00	0.5	1	22	12	2004			3600	157					-0.017296	0.094128		GAMMA5
120904-SOI-03159-01.50	1	1.5	22	12	2004			3600	154					0.0303474	0.0657786		GAMMA18
120904-SOI-03159-02.00	1.5	2	22	12	2004			3600	140					-0.046531	0.0681096		HP
120904-SOI-03159-02.50	2	2.5	22	12	2004			3600	162					0.0199267	0.0793428		GAMMA10
120904-SOI-03159-03.00	2.5	3	22	12	2004			3600	138					-0.013318	0.0870018		GAMMA1
120904-SOI-03159-05.50	5	5.5	22	12	2004			3600	159					0.1054722	0.138195		GAMMA3
120904-SOI-03159-06.00	5.5	6	22	12	2004			3600	140					-0.06842	0.1047618		GAMMA5
120904-SOI-03159-06.50	6	6.5	22	12	2004			3600	137					0.0505938	0.0912642		GAMMA8
120904-SOI-03159-07.00	6.5	7	22	12	2004			3600	133					0.0025552	0.0903984		GAMMA10
120904-SOI-03159-07.50	7	7.5	22	12	2004			3600	151					-0.024198	0.0965922		GAMMA12

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

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Client: CH2M Hill - Herb Kelly

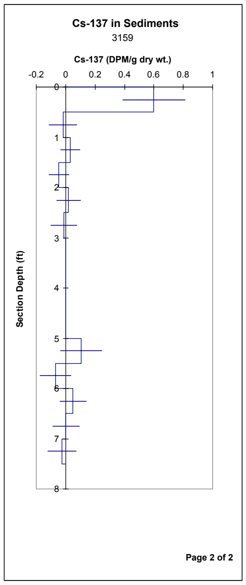
Core ID: 3159
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

This table must remain open for chart to plot.

Section No.	Sample ID	Upper depth (ft)	Lower depth (ft)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	120904-SOI-03159-00.50	0	0.5	0.60	0.21
2	120904-SOI-03159-01.00	0.5	1	-0.02	0.09
3	120904-SOI-03159-01.50	1	1.5	0.03	0.07
4	120904-SOI-03159-02.00	1.5	2	-0.05	0.07
5	120904-SOI-03159-02.50	2	2.5	0.02	0.08
6	120904-SOI-03159-03.00	2.5	3	-0.01	0.09
7	120904-SOI-03159-05.50	5	5.5	0.11	0.14
8	120904-SOI-03159-06.00	5.5	6	-0.07	0.10
9	120904-SOI-03159-06.50	6	6.5	0.05	0.09
10	120904-SOI-03159-07.00	6.5	7	0.00	0.09
11	120904-SOI-03159-07.50	7	7.5	-0.02	0.10



Plot Table X Values	Plot Table Y Values
0	0
0.59962	0
0.59962	0.25
0.8105	0.25
0.38874	0.25
0.59962	0.25
0.59962	0.5
0	0.5
0	0.5
-0.0173	0.5
-0.0173	0.75
0.07683	0.75
-0.11142	0.75
-0.0173	0.75
-0.0173	1
0	1
0	1
0.03035	1
0.03035	1.25
0.09613	1.25
-0.03543	1.25
0.03035	1.25
0.03035	1.5
0	1.5
0	1.5
-0.04653	1.5
-0.04653	1.75
0.02158	1.75
-0.11464	1.75
-0.04653	1.75
-0.04653	2
0	2
0	2
0.01993	2
0.01993	2.25
0.09927	2.25
-0.05942	2.25
0.01993	2.25
0.01993	2.5
0	2.5
0	2.5
-0.01332	2.5
-0.01332	2.75
0.07368	2.75
-0.10032	2.75
-0.01332	2.75
-0.01332	3
0	3
0	5
0.10547	5
0.10547	5.25
0.24367	5.25
-0.03272	5.25
0.10547	5.25
0.10547	5.5
0	5.5
0	5.5
-0.06842	5.5
-0.06842	5.75
0.03634	5.75
-0.17318	5.75
-0.06842	5.75
-0.06842	6
0	6
0	6
0.05059	6
0.05059	6.25
0.14186	6.25
-0.04067	6.25
0.05059	6.25
0.05059	6.5
0	6.5
0	6.5
0.00256	6.5
0.00256	6.75
0.09295	6.75
-0.08784	6.75
0.00256	6.75
0.00256	7
0	7
0	7
-0.0242	7
-0.0242	7.25
0.07239	7.25
-0.12079	7.25
-0.0242	7.25
-0.0242	7.5
0	7.5

Herb Kelly
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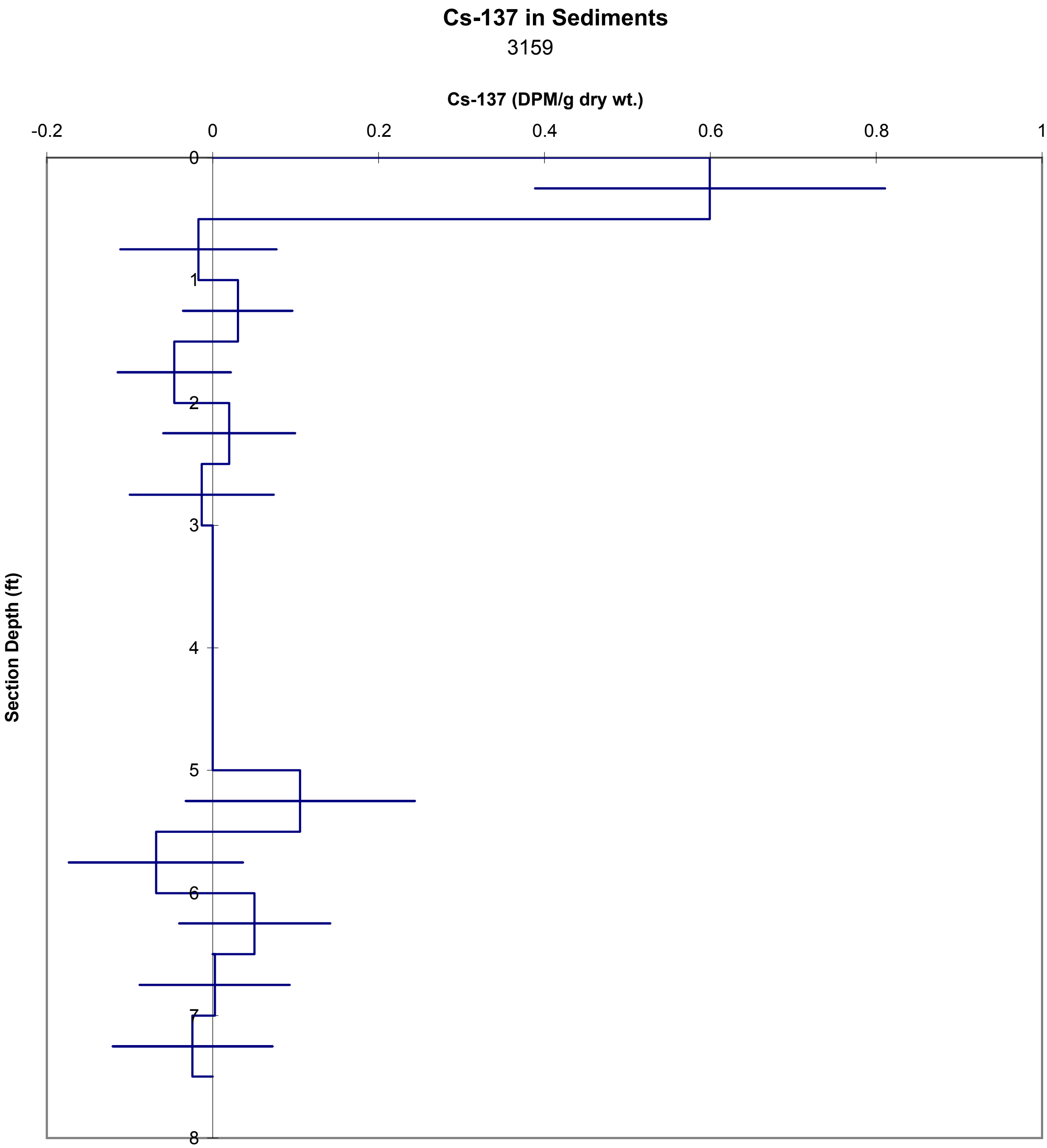
Gainesville, FL



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Results of Pb-210 Analysis

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PO/Contract No.: 905218

Core ID: 3159

Date(s) Received: Feb. 8, 2005

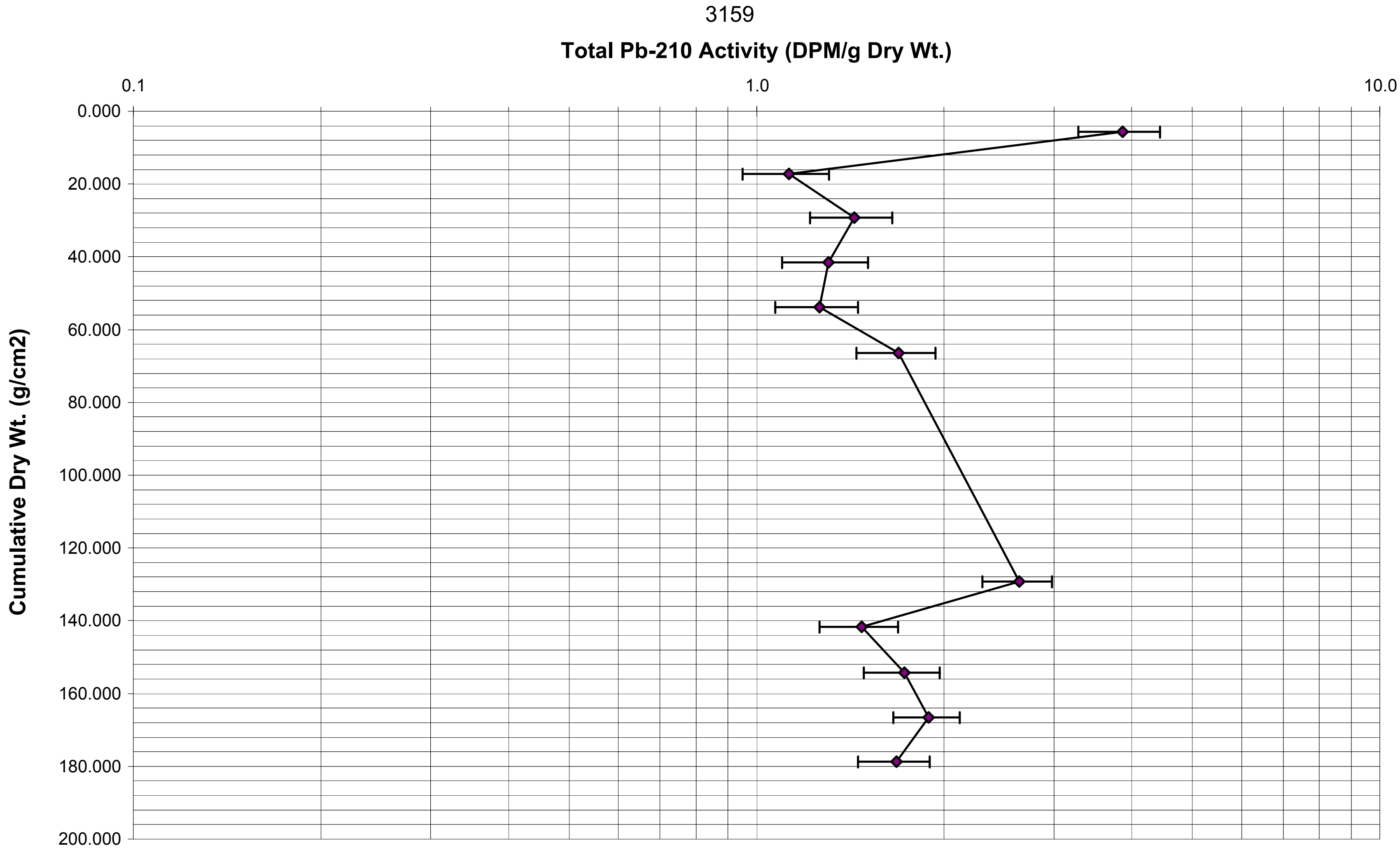
Date(s) Analysed:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1		120904-SOI-03159-00.5C	127270020	0.50	0.00	0.50	0.00	0.50	0.739	11.257	11.257	5.629	340.97	484.485	1.663	30300	3.86	0.58	2.24			
2		120904-SOI-03159-01.0C	127271001	0.50	0.50	1.00	0.50	1.00	0.784	11.949	23.206	17.232	855	280	1.562	60000	1.13	0.18				
3		120904-SOI-03159-01.5C	127271002	0.50	1.00	1.50	1.00	1.50	0.795	12.115	35.321	29.263	831	338	1.525	60000	1.43	0.22				
4		120904-SOI-03159-02.0C	127271003	0.50	1.50	2.00	1.50	2.00	0.811	12.367	47.688	41.504	799	293	1.511	60000	1.31	0.21				
5		120904-SOI-03159-02.5C	127271004	0.50	2.00	2.50	2.00	2.50	0.808	12.313	60.000	53.844	913	325	1.515	60000	1.26	0.19				
6		120904-SOI-03159-03.0C	127271005	0.50	2.50	3.00	2.50	4.00	0.838	38.292	98.293	66.382	866	414	1.52	60000	1.69	0.24				
7		120904-SOI-03159-05.5C	127271006	0.50	5.00	5.50	4.00	5.50	0.811	37.073	135.365	129.186	954	712	1.514	60000	2.64	0.34				
8		120904-SOI-03159-06.0C	127271007	0.50	5.50	6.00	5.50	6.00	0.834	12.713	148.078	141.721	976	403	1.506	60000	1.47	0.21				
9		120904-SOI-03159-06.5C	127271008	0.50	6.00	6.50	6.00	6.50	0.812	12.369	160.446	154.262	909	442	1.514	60000	1.73	0.24				
10		120904-SOI-03159-07.0C	127271009	0.50	6.50	7.00	6.50	7.00	0.800	12.195	172.642	166.544	929	494	1.515	60000	1.89	0.23				
11		120904-SOI-03159-07.5C	127271010	0.50	7.00	7.50	7.00	7.50	0.799	12.179	184.821	178.731	864	404	1.5	60000	1.68	0.22				
																		Total Excess DPM in core =			25.24776385	
																Avg. BKG =	1.62			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussion

Total Pb-210 Activity vs. Accumulated Sediment



Radionuclide Results for Core 3160

Flett Research Ltd.

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Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928

Transaction ID:

PO/Contract No.: 905218

Core ID: 3160

Date(s) Received: Feb 8, 2005

Date(s) Analysed:

Sampling Date(s):

Analyst(s):

Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

The profile of Pb-210 is essentially vertical in this core and it is impossible to apply the Pb-210 dating technique. The average activity of the Pb-210 is fairly low (about 1.5 DPM/g) and could be due solely to the presence of Ra-226 in the sediment.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

Conclusion:

There is a significant Cs-137 peak in section 2 (0.5 - 1.0 ft) of the core. This suggests that the period of maximum Cs-137 input, from 19
1963, is captured in this section. Approximate estimates of sediment accumulation rates can be made: If the top of section 2 is at 1963, then the rate of accumulation is 0.5 ft / (2004 - 1963)yr = 0.0122 ft/yr ; if the bottom of section 2 is at 1958, then the rate of accumulatio
1.0 ft / (2004 - 1958)yr = 0.02174 ft/yr. The range of rates is 0.0122 - 0.0217 ft/yr and in fact could be broader because the adjacent core sections may also contain small amounts of Cs-137.

Results of Cs-137 Analysis

Flett Research Ltd.

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Client: **CH2M HILL - Herb Kelly**
Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

Transaction ID:
PO/Contract No.: 905218

Core ID: 3160
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
121004-SOI-03160-00.50	0	0.5	24	12	2004			3600	144					0.1447218	0.170718		GAMMA5
121004-SOI-03160-01.00	0.5	1	24	12	2004	78	15.91	3600	115			0.0191		0.693306	0.282828		GAMMA6
121004-SOI-03160-01.50	1	1.5	23	12	2004			3600	122					0.1177266	0.1928958		GAMMA16
121004-SOI-03160-02.00	1.5	2	23	12	2004			3600	135					0.0016859	0.0929514		GAMMA17
121004-SOI-03160-02.50	2	2.5	22	12	2004			3600	130					0.1020756	0.326784		GAMMA6
121004-SOI-03160-03.00	2.5	3	22	12	2004			3600	134					0.0927516	0.0810522		GAMMA7
121004-SOI-03160-00.50(1273920			26	12	2004			3600	144					0	0.1161726		HP
121004-SOI-03160-01.00(1273920			26	12	2004	101	20.76	3600	115			0.01906		0.905316	0.372294		GAMMA5
121004-SOI-03160-01.50(1273950			23	12	2004			3600	122					0.065157	0.228882		GAMMA2
121004-SOI-03160-02.00(1273950			23	12	2004			3600	135					0.0711954	0.0911754		GAMMA3
121004-SOI-03160-02.05(1273990			23	12	2004			3600	130					0.0251748	0.0954156		GAMMA10
121004-SOI-03160-03.00(1273990			23	12	2004			3600	134					0.0314796	0.0843822		GAMMA12

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

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Client: CH2M Hill - Herb Kelly

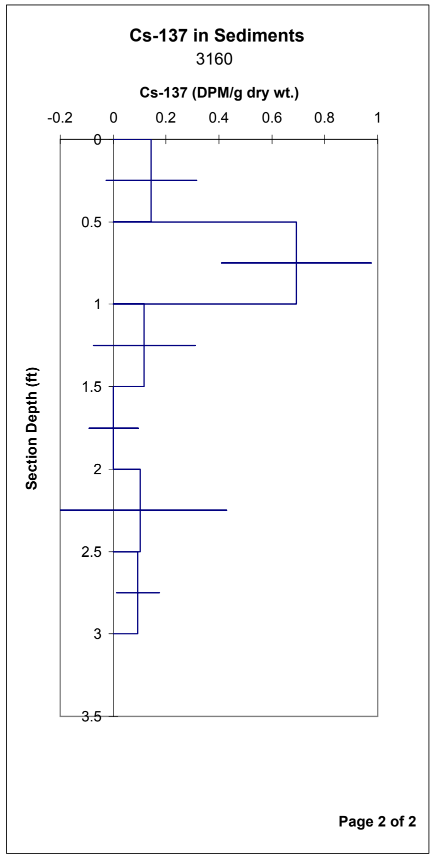
Core ID: 3160
Date(s) Received Feb. 8, 2005
Sampling Date(s)
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

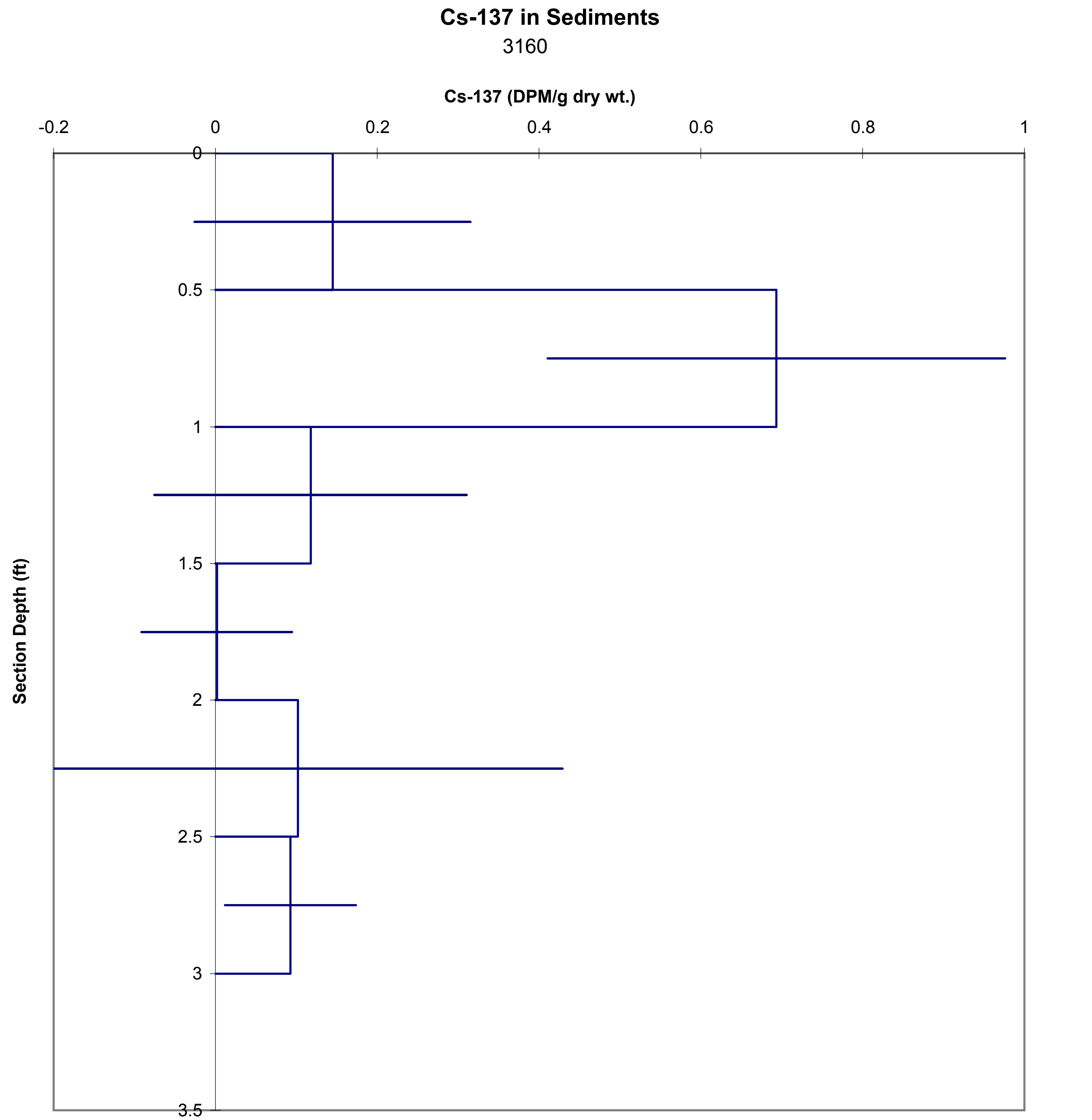
This table must remain open for chart to plot.

Section No.	Sample ID	Upper depth (ft)	Lower depth (ft)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	121004-SOI-03160-00.50	0	0.5	0.14	0.17
2	121004-SOI-03160-01.00	0.5	1	0.69	0.28
3	121004-SOI-03160-01.50	1	1.5	0.12	0.19
4	121004-SOI-03160-02.00	1.5	2	0.00	0.09
5	121004-SOI-03160-02.50	2	2.5	0.10	0.33
6	121004-SOI-03160-03.00	2.5	3	0.09	0.08



Plot Table X Values	Plot Table Y Values
0	0
0.144722	0
0.144722	0.25
0.31544	0.25
-0.026	0.25
0.144722	0.25
0.144722	0.5
0	0.5
0	0.5
0.693306	0.5
0.693306	0.75
0.976134	0.75
0.410478	0.75
0.693306	0.75
0.693306	1
0	1
0	1
0.117727	1
0.117727	1.25
0.310622	1.25
-0.07517	1.25
0.117727	1.25
0.117727	1.5
0	1.5
0	1.5
0.001686	1.5
0.001686	1.75
0.094637	1.75
-0.09127	1.75
0.001686	1.75
0.001686	2
0	2
0	2
0.102076	2
0.102076	2.25
0.42886	2.25
-0.22471	2.25
0.102076	2.25
0.102076	2.5
0	2.5
0	2.5
0.092752	2.5
0.092752	2.75
0.173804	2.75
0.011699	2.75
0.092752	2.75
0.092752	3
0	3

Herb Kelly
CH2M Hill
Gainesville, FL



Data Analysis by Flett Research Ltd.
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Canada R2L 0Y7
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4/28/2005

Results of Pb-210 Analysis

Flett Research Ltd.

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Delete extra charts AFTER printing!

Client: **CH2M HILL - Herb Kelly** **Transaction ID:**

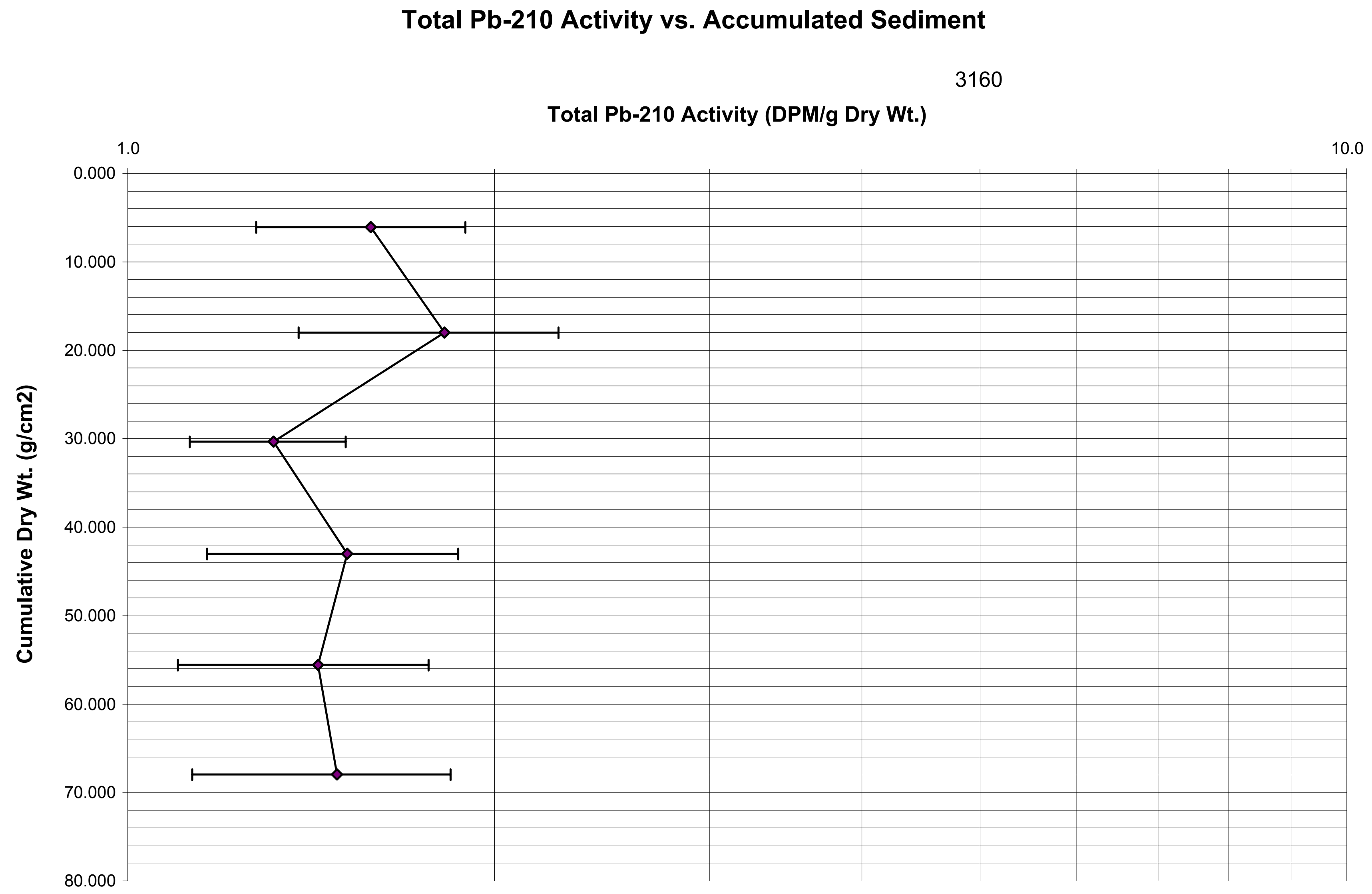
Address: 3011 S.W. Williston Road **PO/Contract No.:** 905218
Gainesville, FL 32608-3928

Core ID: 3160
Date(s) Received: Feb. 8, 2005 **Date(s) Analysed:**

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1		121004-SOI-03160-00.5C	127392001	**0.50**	**0.00**	**0.50**	0.00	0.50	0.800	12.186	12.186	6.093	372.94	165.445	1.505	30300	**1.58**	**0.31**				
2		121004-SOI-03160-01.0C	127392002	**0.50**	**0.50**	**1.00**	0.50	1.00	0.761	11.593	23.779	17.982	209.96	124.465	1.515	30300	**1.82**	**0.44**				
3		121004-SOI-03160-01.5C	127395001	**0.50**	**1.00**	**1.50**	1.00	1.50	0.858	13.079	36.857	30.318	809	297	1.508	60000	**1.32**	**0.19**				
4		121004-SOI-03160-02.0C	127395002	**0.50**	**1.50**	**2.00**	1.50	2.00	0.809	12.329	49.187	43.022	249.485	122.485	1.506	30300	**1.51**	**0.35**				
5		121004-SOI-03160-02.5C	127399001	**0.50**	**2.00**	**2.50**	2.00	2.50	0.834	12.715	61.902	55.544	255.93	122.97	1.542	30300	**1.43**	**0.33**				
6		121004-SOI-03160-03.0C	127399002	**0.50**	**2.50**	**3.00**	2.50	3.00	0.796	12.134	74.036	67.969	226.97	118.455	1.615	30300	**1.49**	**0.36**				
																		Total Excess DPM in core =			0	
																Avg. BKG =	**1.51**			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussion


Total Pb-210 Activity vs. Accumulated Sediment
3160
Total Pb-210 Activity (DPM/g Dry Wt.)
1.0
10.0
0.000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
Cumulative Dry Wt. (g/cm2)

Page 3 of 7

Radionuclide Results for Core 3161

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Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928

Transaction ID:

PO/Contract No.: 905218

Core ID: 3161
Date(s) Received: Feb 8, 2005
Date(s) Analysed:
Sampling Date(s):
Analyst(s):
Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

Pb-210 appears to be above background only in the top section (0 - 0.5 ft) of the core (4.35 DPM/g). The deeper sections of the core (0.5 - 2.5 ft) are probably at background Pb-210 levels, with an average activity of 1.77 DPM/g and significant variation throughout the core (1.4 - 2.26 DPM/g). The Pb-210 models cannot be applied with only a single section showing excess Pb-210.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2)

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

Conclusion:

Cs-137 is detected only in the top core section, indicating that the bottom edge of the section (at 0.5 ft depth) predates 1954, the year when significant fallout of atmospheric Cs-137 began. Based on this, the sediment accumulation rate is probably less than 0.5 ft / (2004 - 1954) = 0.010 ft/yr or 10.353 / 50 = 0.207 g/cm2/yr.

Results of Cs-137 Analysis

Flett Research Ltd.

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Client: **CH2M HILL - Herb Kelly**

Transaction ID:

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

PO/Contract No.: 905218

Core ID: 3161

Date(s) Received: Feb. 8, 2005

Date(s) Analysed:

Sampling Date(s):

Analyst(s):

Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
121004-SOI-03161-00.50	0	0.5	23	12	2004	179	21.48	3600	118			0.03619		0.820734	0.197025		GAMMA18
121004-SOI-03161-01.00	0.5	1	23	12	2004			3600	124					0.1301364	0.1134642		HP
121004-SOI-03161-01.50	1	1.5	23	12	2004			3600	124					-0.006713	0.1131312		GAMMA6
121004-SOI-03161-02.00	1.5	2	23	12	2004			3600	126					0.0890664	0.106116		GAMMA7
121004-SOI-03161-02.50	2	2.5	23	12	2004			3600	154					-0.032234	0.0712176		GAMMA8

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

Flett Research Ltd.
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E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M Hill - Herb Kelly

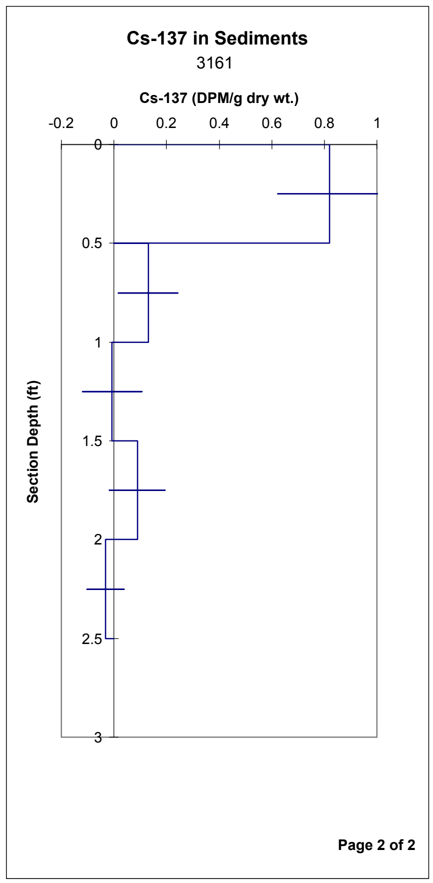
Core ID: 3161
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

This table must remain open for chart to plot.

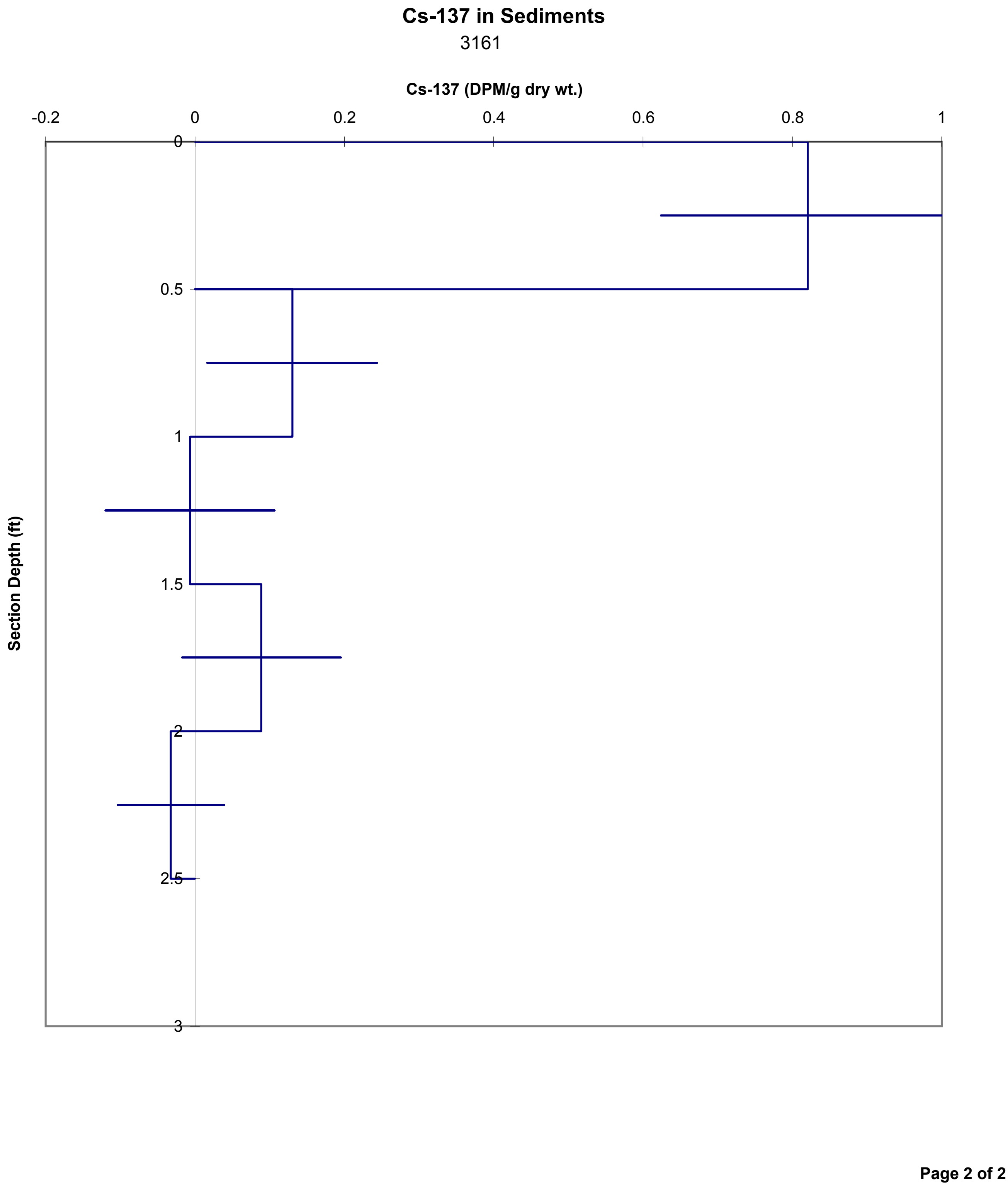
Section No.	Sample ID	Upper depth (ft)	Lower depth (ft)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	121004-SOI-03161-00.50	0	0.5	0.82	0.20
2	121004-SOI-03161-01.00	0.5	1	0.13	0.11
3	121004-SOI-03161-01.50	1	1.5	-0.01	0.11
4	121004-SOI-03161-02.00	1.5	2	0.09	0.11
5	121004-SOI-03161-02.50	2	2.5	-0.03	0.07



Plot Table X Values	Plot Table Y Values
0	0
0.820734	0
0.820734	0.25
1.017759	0.25
0.623709	0.25
0.820734	0.25
0.820734	0.5
0	0.5
0	0.5
0.130136	0.5
0.130136	0.75
0.243601	0.75
0.016672	0.75
0.130136	0.75
0.130136	1
0	1
0	1
-0.00671	1
-0.00671	1.25
0.106418	1.25
-0.11984	1.25
-0.00671	1.25
-0.00671	1.5
0	1.5
0	1.5
0.089066	1.5
0.089066	1.75
0.195182	1.75
-0.01705	1.75
0.089066	1.75
0.089066	2
0	2
0	2
-0.03223	2
-0.03223	2.25
0.038983	2.25
-0.10345	2.25
-0.03223	2.25
-0.03223	2.5
0	2.5

Core 3161

Herb Kelly
CH2M Hill
Gainesville, FL



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4/28/2005

Results of Pb-210 Analysis

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Client: **CH2M HILL - Herb Kelly**

Transaction ID:

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

PO/Contract No.: 905218

Core ID: 3161

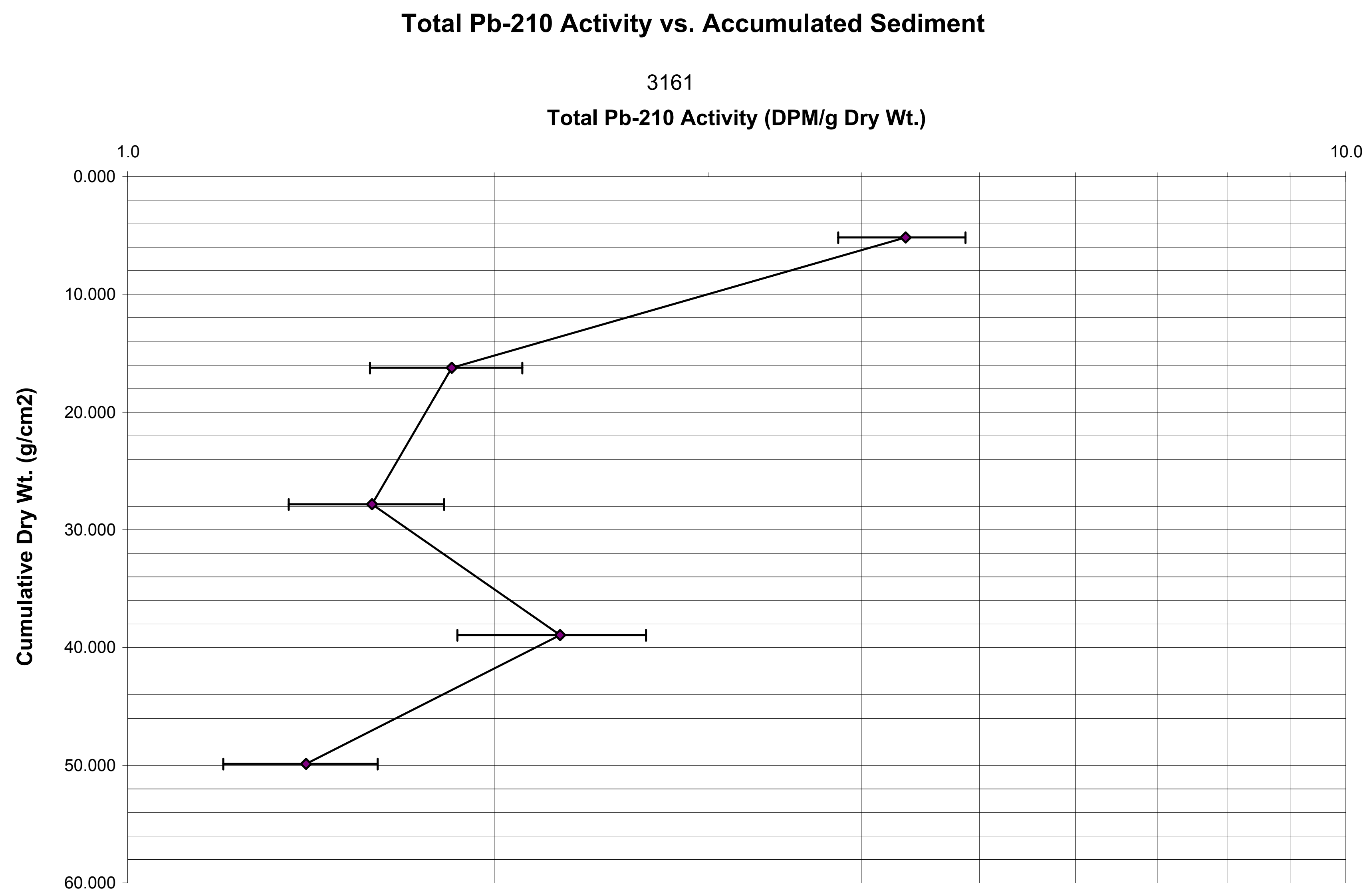
Date(s) Received: Feb. 8, 2005

Date(s) Analysed:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1	127395015	0.50	0.00	0.50	0.00	0.50	0.679	10.353	10.353	5.177	912	1177	1.601	60000	4.35	0.52	2.58			
2	127395016	0.50	0.50	1.00	0.50	1.00	0.771	11.748	22.101	16.227	825	429	1.524	60000	1.84	0.26				
3	127395017	0.50	1.00	1.50	1.00	1.50	0.750	11.431	33.532	27.816	876	393	1.529	60000	1.59	0.23				
4	127395018	0.50	1.50	2.00	1.50	2.00	0.708	10.783	44.315	38.924	583.8	244.36	1.015	43200	2.26	0.40				
5	127395019	0.50	2.00	2.50	2.00	2.50	0.732	11.160	55.475	49.895	761	308	1.562	60000	1.40	0.20				
																Total Excess DPM in core =			26.72320154	
														Avg. BKG =	1.77			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussio


Total Pb-210 Activity vs. Accumulated Sediment
3161
Total Pb-210 Activity (DPM/g Dry Wt.)
1.0
10.0
0.000
10.000
20.000
30.000
40.000
50.000
60.000
Cumulative Dry Wt. (g/cm2)

Radionuclide Results for Core 3162

Flett Research Ltd.
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Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928
Transaction ID:
PO/Contract No.: 905218
Core ID: 3162
Date(s) Received: Feb 8, 2005
Date(s) Analysed:
Sampling Date(s):
Analyst(s):
Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

There were duplicate measurements made for each section of this core and therefore the duplicates were averaged and the average activity of each section was used in the plots and calculations. The duplicate bulk density measurements were similar and therefore the data from the first set of measurements were used to determine cumulative mass in the core. The core exhibits a steady decrease in Pb-210 activity as a function of depth. The surface section (0 - 0.5 ft) has a Pb-210 activity of 3.33 DPM/g which is significantly above the average activity of 0.38 DPM/g seen in the bottom 3 sections.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

The regression graph on Page 5 includes sections 1 - 3. It assumes constant input of Pb-210 and a constant rate of sediment accumulation. Initial trials with the model indicated that the background estimated from an average of the lowest 3 sections was unsuitable because it caused the Regression and CRS models to diverge, and, it was at odds with the Cs-137 results. Assuming section 4 was at background solved these problems and therefore the activity of 0.61 DPM/g seen in section 4 was deemed appropriate for both the Pb-210 models. The Regression model found the best fit (R2= 1.00) when a background of 0.5771 DPM/g was chosen and predicted a sediment accumulation rate of 0.2369 g/cm2/yr (see R2 Table on Page 4). When forced to use the background of 0.61 DPM/g, the fit was still good (R2 = 0.9984) and the sediment accumulation rate was predicted at 0.2168 g/cm2/yr. This is equivalent to an age of 11.574 g/cm2 / 0.2168 g/cm2/yr = 53.4 yr at 0.5 ft depth in the core, and a linear rate of sediment accumulation of 0.5 ft / 53.4 yr = 0.0094 ft/yr..

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

The CRS model includes sections 1- 4. It assumes constant input of Pb-210 and a core that is long enough to include all of the measurable atmospheric source Pb-210. If one assumes that the lowest measured activity in the modelled sections of the core (0.61 DPM/g) is the background Pb-210 level, then the CRS model can be applied. The results are shown in column Z of the main data table on Page 2. The average sediment accumulation rate in the upper 2 sections was 0.2124 g/cm2/yr (col. AK of Page 2). The model predicts an age of 52 yr for the depth of 0.5 ft in the core (Page 2) and 0.5 ft / 52 yr = 0.0096 ft/yr for a linear rate of sediment accumulation.

Conclusion:

There is significant Cs-137 in the upper section (0.0 - 0.5 ft) and there may be some Cs-137 in section 2 (0.5 - 1.0 ft).For purposes of calculation, it is assumed that the bottom of section 1 is at 1958 and thus the majority of the Cs-137 has been captured in this section, and , that smaller amounts of the radionuclide, deposited from 1954 - 1958 may be present in section 2. If 1958 occurs at 0.5 ft, then a sediment accumulation rate can estimated to be 0.5 ft / (2004 - 1958) = 0.0109 ft/yr. [It is possible that section 2 contains no Cs-137 and therefore the sediment accumulation rate could be significantly lower]. This rate estimated by Cs-137 is similar to the 0.0096 ft /yr predicted by the CRS model and the 0.0094 ft/yr predicted by the Regression model.

Results of Cs-137 Analysis

Flett Research Ltd.

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Client: **CH2M HILL - Herb Kelly**

Address: 3011 S.W. Williston Road
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Core ID: 3162

Date(s) Received: Feb. 8, 2005

Sampling Date(s):

Project:

Transaction ID:

PO/Contract No.: 905218

Date(s) Analysed:

Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
121004-SOI-03162-00.50	0	0.5	23	12	2004	94	14.01	3600	130			0.02427		0.584748	0.1742922		GAMMA10
121004-SOI-03162-01.00	0.5	1	23	12	2004			3600	136					0	0.234432		GAMMA6
121004-SOI-03162-01.50	1	1.5	23	12	2004			3600	149					0.100788	0.0867132		GAMMA7
121004-SOI-03162-02.00	1.5	2	23	12	2004			3600	175					0.0488178	0.0529026		GAMMA8
121004-SOI-03162-02.50	2	2.5	23	12	2004			3600	152					0.0360972	0.0816072		GAMMA9
121004-SOI-03162-05.50	5	5.5	23	12	2004			3600	160					0.03885	0.0723054		GAMMA12
121004-SOI-03162-06.00	5.5	6	23	12	2004			3600	157					0.0975912	0.111444		GAMMA16
121004-SOI-03162-00.50-D(12740			23	12	2004	223	20.06	3600	130			0.03618		0.92796	0.166944		GAMMA18
121004-SOI-03162-00.50-D			23	12	2004	115	16.46	3600	130			0.02214		0.779442	0.22311		GAMMA16
121004-SOI-03162-01.00-D			28	12	2004			5202	132					0.0698412	0.0607614		HP
121004-SOI-03162-01.50-D			23	12	2004			3600	149					-0.0556332	0.0543678		GAMMA18
121004-SOI-03162-02.00-D			23	12	2004			3600	168					-0.0139727	0.0450216		HP
121004-SOI-03162-02.50-D			23	12	2004			3600	163					0.0026751	0.0686202		GAMMA5
121004-SOI-03162-05.50-D			23	12	2004			3600	165					-0.0424464	0.063603		GAMMA2
121004-SOI-03162-06.00-D			23	12	2004			3600	149					-0.0312576	0.0643356		GAMMA3

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

Flett Research Ltd.
440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7
Fax/Phone (204) 667-2505
E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M Hill - Herb Kelly

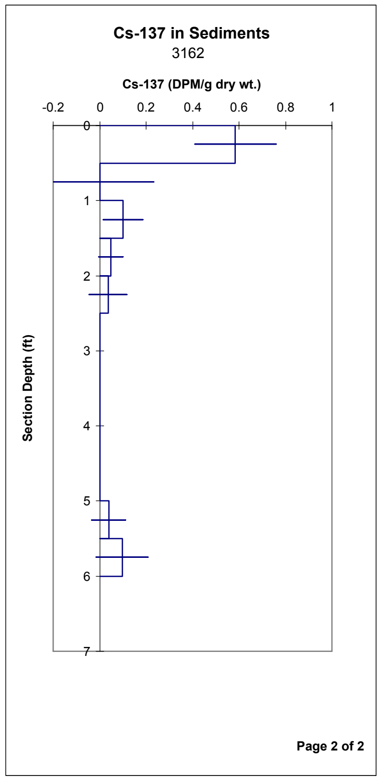
Core ID: 3162
Date(s) Received Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

This table must remain open for chart to plot.

Section No.	Sample ID	Upper depth (ft)	Lower depth (ft)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	121004-SOI-03162-00.50	0	0.5	0.58	0.17
2	121004-SOI-03162-01.00	0.5	1	0.00	0.23
3	121004-SOI-03162-01.50	1	1.5	0.10	0.09
4	121004-SOI-03162-02.00	1.5	2	0.05	0.05
5	121004-SOI-03162-02.50	2	2.5	0.04	0.08
6	121004-SOI-03162-05.50	5	5.5	0.04	0.07
7	121004-SOI-03162-06.00	5.5	6	0.10	0.11

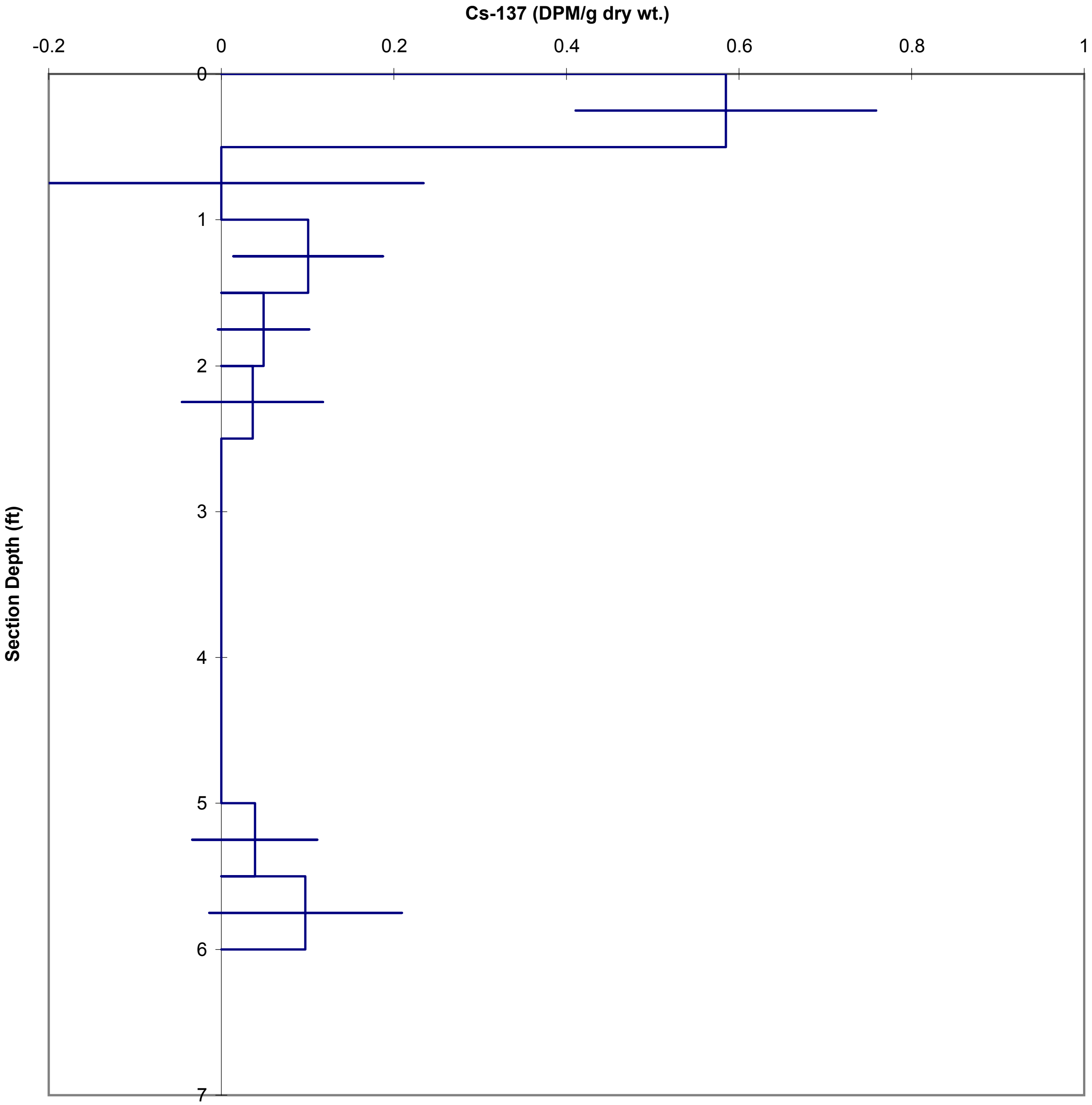


Plot Table X Values	Plot Table Y Values
0	0
0.584748	0
0.584748	0.25
0.75904	0.25
0.410456	0.25
0.584748	0.25
0.584748	0.5
0	0.5
0	0.5
0	0.5
0	0.75
0.234432	0.75
-0.23443	0.75
0	0.75
0	1
0	1
0	1
0.100788	1
0.100788	1.25
0.187501	1.25
0.014075	1.25
0.100788	1.25
0.100788	1.5
0	1.5
0	1.5
0.048818	1.5
0.048818	1.75
0.10172	1.75
-0.00408	1.75
0.048818	1.75
0.048818	2
0	2
0	2
0.036097	2
0.036097	2.25
0.117704	2.25
-0.04551	2.25
0.036097	2.25
0.036097	2.5
0	2.5
0	5
0.03885	5
0.03885	5.25
0.111155	5.25
-0.03346	5.25
0.03885	5.25
0.03885	5.5
0	5.5
0	5.5
0.097591	5.5
0.097591	5.75
0.209035	5.75
-0.01385	5.75
0.097591	5.75
0.097591	6
0	6

Herb Kelly
CH2M Hill
Gainesville, FL

Cs-137 in Sediments

3162



Page 2 of 2

Data Analysis by Flett Research Ltd.
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4/28/2005

Results of Pb-210 Analysis

Flett Research Ltd.

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E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Delete extra charts AFTER printing!

Client: **CH2M HILL - Herb Kelly**

Transaction ID:

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

PO/Contract No.: 905218

Core ID: 3162

Date(s) Received: Feb. 8, 2005

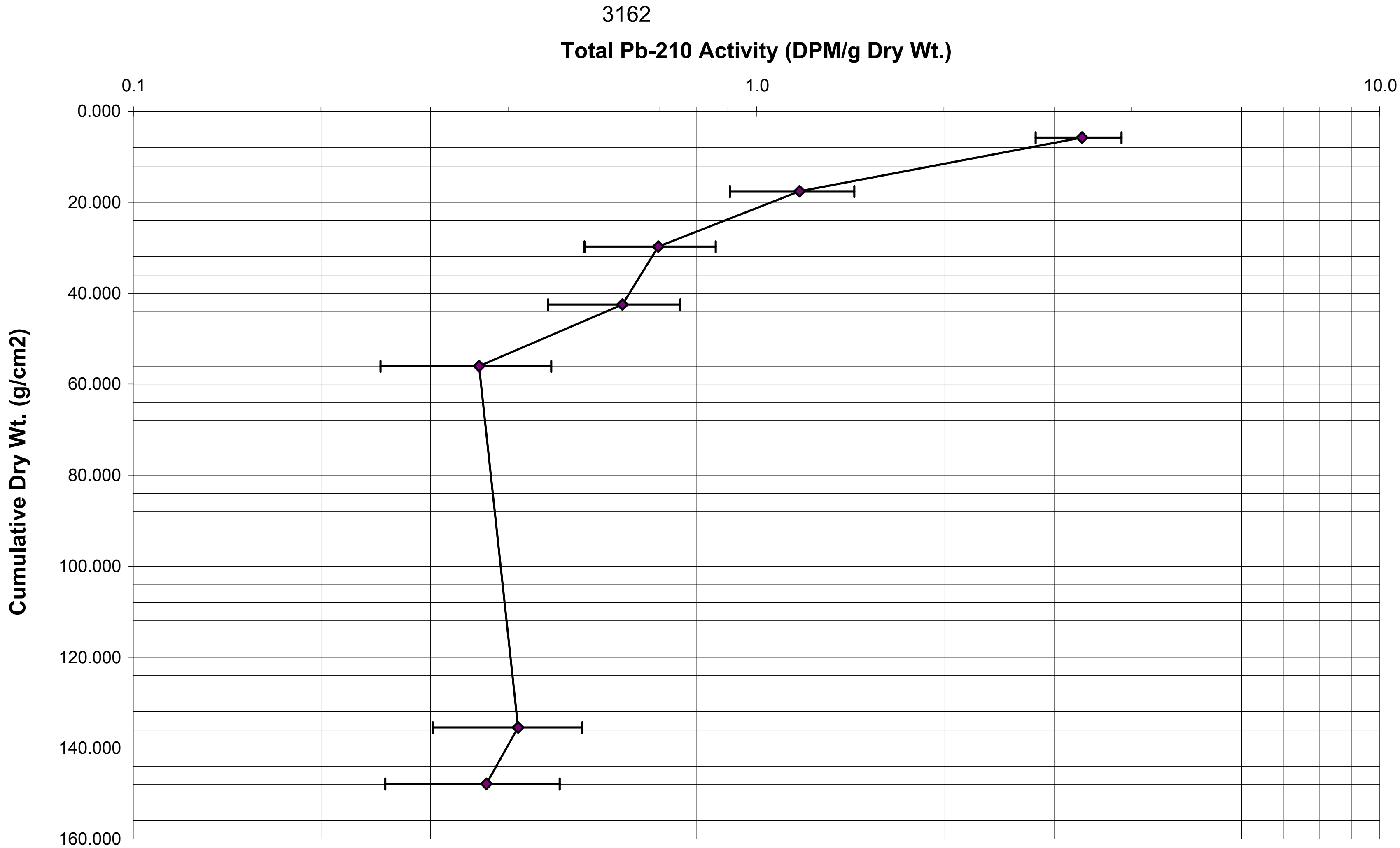
Date(s) Analysed:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate (g/cm^2/yr)
1		121004-SOI-03162-00.5C	127400008	**0.50**	**0.00**	**0.50**	0.00	0.50	0.759	11.574	11.574	5.787	445.485	326.96	1.512	30300	**3.33**	**0.52**	2.72	**52.0**	0.5	0.2227
2		121004-SOI-03162-01.0C	127400009	**0.50**	**0.50**	**1.00**	0.50	1.00	0.793	12.091	23.665	17.620	320.95	115.96	1.505	30300	**1.17**	**0.27**	0.56	**117.1**	1	0.2020
3		121004-SOI-03162-01.5C	127400010	**0.50**	**1.00**	**1.50**	1.00	1.50	0.803	12.238	35.903	29.784	470.405	136.455	1.54	30300	**0.69**	**0.17**	0.08			
4		121004-SOI-03162-02.0C	127400011	**0.50**	**1.50**	**2.00**	1.50	2.00	0.859	13.086	48.989	42.446	1029	89	1.006	60000	**0.61**	**0.15**	0.00			
5		121004-SOI-03162-02.5C	127400012	**0.50**	**2.00**	**2.50**	2.00	3.75	0.931	49.639	98.629	56.081	510.465	55.92	1.504	30300	**0.36**	**0.11**				
6		121004-SOI-03162-05.5C	127400013	**0.50**	**5.00**	**5.50**	3.75	5.50	0.806	42.972	141.600	135.462	476.97	75.98	1.59	30300	**0.41**	**0.11**				
7		121004-SOI-03162-06.0C	127400014	**0.50**	**5.50**	**6.00**	5.50	6.00	0.815	12.414	154.014	147.807	417.475	45.485	1.545	30300	**0.37**	**0.12**				
																	2.26	**0.35**				
																	1.11	**0.25**				
																	0.87	**0.18**				
																	0.48	**0.12**				
																	0.34	**0.10**				
																	0.47	**0.12**				
																	0.33	**0.10**				
		121004-SOI-03162-00.50-D	127400001	**0.50**	**0.00**	**0.50**	0.00	0.50	0.752	11.465	11.465	5.732	353.96	505.465	1.507	30300	**4.40**	**0.70**				
		121004-SOI-03162-01.00-D	127400002	**0.50**	**0.50**	**1.00**	0.50	1.00	0.789	12.020	23.485	17.475	298.93	118.98	1.506	30300	**1.23**	**0.28**				
		121004-SOI-03162-01.50-D	127400003	**0.50**	**1.00**	**1.50**	1.00	1.50	0.805	12.271	35.756	29.621	341	56.98	1.507	30300	**0.52**	**0.15**				
		121004-SOI-03162-02.00-D	127400004	**0.50**	**1.50**	**2.00**	1.50	2.00	0.830	12.647	48.403	42.080	424	101.96	1.502	30300	**0.74**	**0.18**				
		121004-SOI-03162-02.50-D	127400005	**0.50**	**2.00**	**2.50**	2.00	3.75	0.900	48.027	96.430	55.264	426	52.98	1.524	30300	**0.38**	**0.12**				
		121004-SOI-03162-05.50-D	127400006	**0.50**	**5.00**	**5.50**	3.75	5.50	0.835	44.512	140.942	134.583	449	55.97	1.597	30300	**0.36**	**0.11**				
		121004-SOI-03162-06.00-D	127400007	**0.50**	**5.50**	**6.00**	5.50	6.00	0.789	12.027	152.969	146.955	377.455	49.98	1.502	30300	**0.41**	**0.13**				
																		Total Excess DPM in core =			39.29656217	
																Avg. BKG =	**0.38**			Avg. Sed. Rate =		0.2124

*: See 'Comments' section on 'Interpretation' sheet for discussion

Total Pb-210 Activity vs. Accumulated Sediment



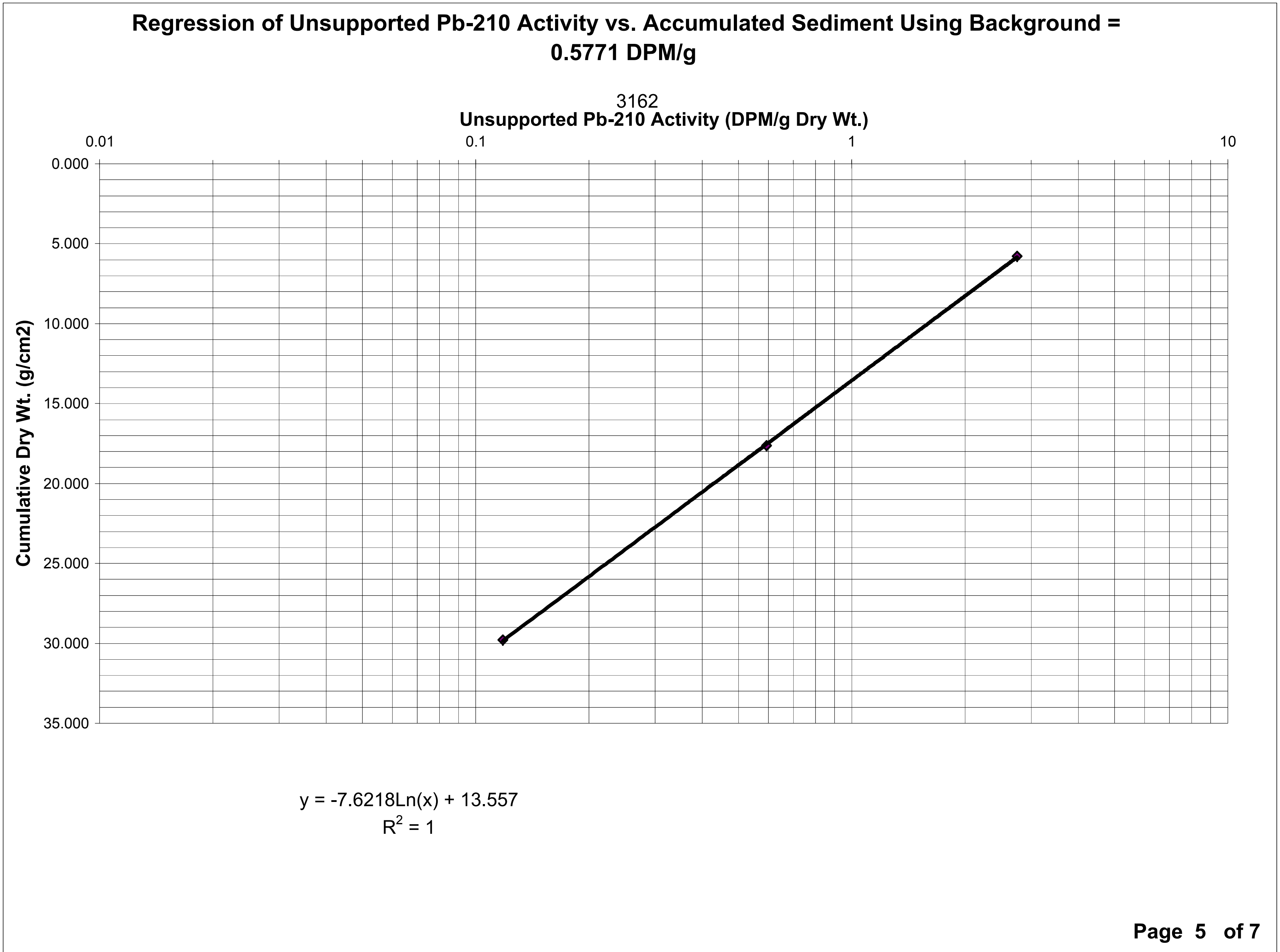
r^2 fit as a function of background subtracted

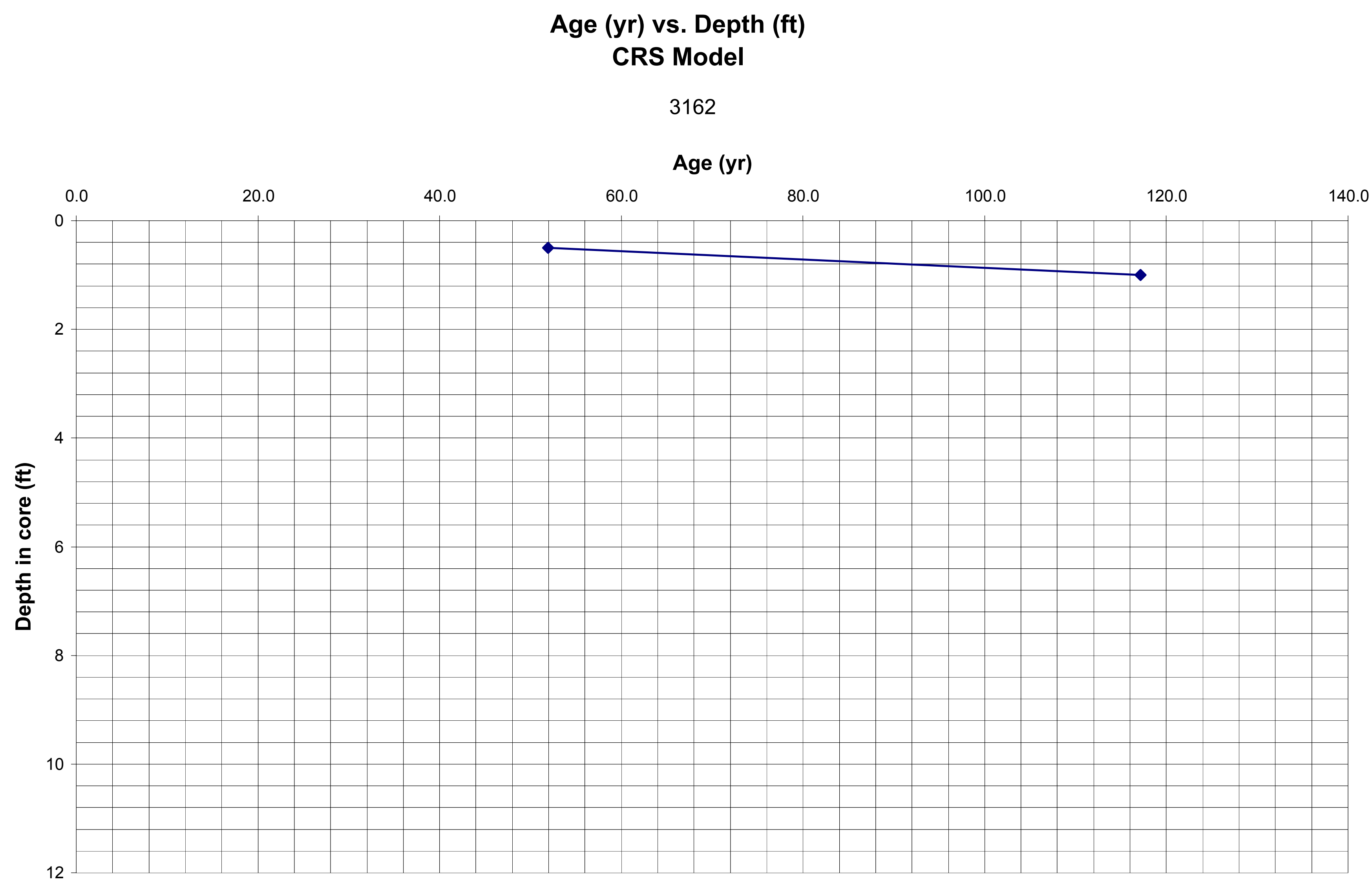
bkg (DPM/g)		r^2	Sediment Accumu-lation Rate ($g/cm^2/yr$)	Slope 'm'	Y inter-cept 'b'
0.0000		0.9612	0.4582	-14.74	22.63
0.0304		0.9629	0.4489	-14.44	22.14
0.0607		0.9647	0.4394	-14.14	21.66
0.0911		0.9666	0.4298	-13.83	21.18
0.1214		0.9686	0.4201	-13.52	20.70
0.1518		0.9706	0.4103	-13.20	20.22
0.1821		0.9727	0.4003	-12.88	19.74
0.2125		0.9749	0.3901	-12.55	19.26
0.2428		0.9771	0.3798	-12.22	18.78
0.2732		0.9794	0.3692	-11.88	18.31
0.3035		0.9818	0.3584	-11.53	17.83
0.3339		0.9843	0.3472	-11.17	17.36
0.3643		0.9867	0.3358	-10.80	16.89
0.3947		0.9892	0.3239	-10.42	16.41
0.4251		0.9917	0.3115	-10.02	15.94
0.4555		0.9941	0.2986	-9.61	15.47
0.4859		0.9964	0.2849	-9.17	14.99
0.5163		0.9983	0.2703	-8.70	14.51
0.5467		0.9996	0.2544	-8.19	14.04
0.5771		1.0000	0.2369	-7.62	13.56
0.6075		0.9984	0.2168	-6.98	13.07

Note: Used Column BY for Background Subtraction.

0

Note: this table presents results of Pb-210 linear regression model for a range of Pb-210 background activity levels. The model is applied assuming constant sediment accumulation rate. The model is used to generate 20 regressions using different values of background, across the possible range from zero activity to the lowest observed sample activity. The quality of the fit is an indication of the quality of the assumed background activities. The table above shows the R2 value obtained with each choice of background, as well as the corresponding sediment accumulation rate, intercept and slope of the regression line.


Regression of Unsupported Pb-210 Activity vs. Accumulated Sediment Using Background = 0.5771 DPM/g
3162
Unsupported Pb-210 Activity (DPM/g Dry Wt.)
0.01
0.1
1
10
Cumulative Dry Wt. (g/cm2)
0.000
5.000
10.000
15.000
20.000
25.000
30.000
35.000
y = -7.6218Ln(x) + 13.557
R2 = 1


Age (yr) vs. Depth (ft)
CRS Model
3162
Age (yr)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
0
2
4
6
8
10
12
Depth in core (ft)

CRS Sediment accumulation rate (g/cm2/year) vs Depth at the bottom of section in core (ft)

Radionuclide Results for Core 3163

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7

Fax/Phone (204) 667-2505

E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928

Transaction ID:

PO/Contract No.: 905218

Core ID: 3163

Date(s) Received: Feb 8, 2005

Date(s) Analysed:

Sampling Date(s):

Analyst(s):

Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

Pb-210 appears to be above background only in the top section (0 - 0.5 ft) of the core (1.8 DPM/g). The deeper sections of the core (0.5 - 7.5 ft) are probably at background Pb-210 levels, with an average activity of 0.39 DPM/g and significant variation throughout the core (0 - 0.62 DPM/g). The Pb-210 models cannot be applied with only a single section showing excess Pb-210.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

Conclusion:

Cs-137 is detected only in the top core section, indicating that the bottom edge of the section (at 0.5 ft depth) predates 1954, the year when significant fallout of atmospheric Cs-137 began. Based on this, the sediment accumulation rate is probably less than 0.5 ft / (2004 - 1954) = 0.010 ft/yr or 12.11 / 50 = 0.242 g/cm2/yr.

Results of Cs-137 Analysis

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7
Fax/Phone (204) 667-2505
E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

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Gainesville, FL 32608-3928

Transaction ID:
PO/Contract No.: 905218

Core ID: 3163
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
121004-SOI-03163-00.50	0	0.5	24	12	2004	68	11.37	3600	150			0.02052		0.433788	0.1451658		GAMMA7
121004-SOI-03163-01.00	0.5	1	24	12	2004			3600	160					0.0396936	0.077811		GAMMA8
121004-SOI-03163-01.50	1	1.5	24	12	2004			3600	174					-0.008376	0.0763458		GAMMA9
121004-SOI-03163-02.00	1.5	2	24	12	2004			3600	177					0.0218492	0.0583194		GAMMA10
121004-SOI-03163-02.50	2	2.5	24	12	2004			3600	177					0.0025552	0.0705072		GAMMA16
121004-SOI-03163-05.50	5	5.5	24	12	2004			3600	166					-0.054257	0.0779664		GAMMA17
121004-SOI-03163-06.00	5.5	6	24	12	2004			3600	171					0.0608502	0.0486624		HP
121004-SOI-03163-06.50	6	6.5	24	12	2004			3600	159					0.041292	0.0642246		GAMMA3
121004-SOI-03163-07.00	6.5	7	24	12	2004			3600	171					-0.01062	0.0525474		GAMMA1
121004-SOI-03163-07.50	7	7.5	24	12	2004			3600	181					-0.04551	0.0686202		GAMMA5
121004-SOI-03163-08.00	7.5	8	24	12	2004			3600	181					0.0017804	0.0678876		GAMMA6

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

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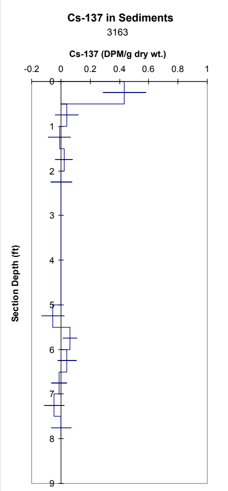
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

This table must remain open for chart to plot.

Section No.	Sample ID	Upper depth (ft)	Lower depth (ft)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	121004-SOI-03163-00.50	0	0.5	0.43	0.15
2	121004-SOI-03163-01.00	0.5	1	0.04	0.08
3	121004-SOI-03163-01.50	1	1.5	-0.01	0.08
4	121004-SOI-03163-02.00	1.5	2	0.02	0.06
5	121004-SOI-03163-02.50	2	2.5	0.00	0.07
6	121004-SOI-03163-05.50	5	5.5	-0.05	0.08
7	121004-SOI-03163-06.00	5.5	6	0.06	0.05
8	121004-SOI-03163-06.50	6	6.5	0.04	0.06
9	121004-SOI-03163-07.00	6.5	7	-0.01	0.05
10	121004-SOI-03163-07.50	7	7.5	-0.05	0.07
11	121004-SOI-03163-08.00	7.5	8	0.00	0.07

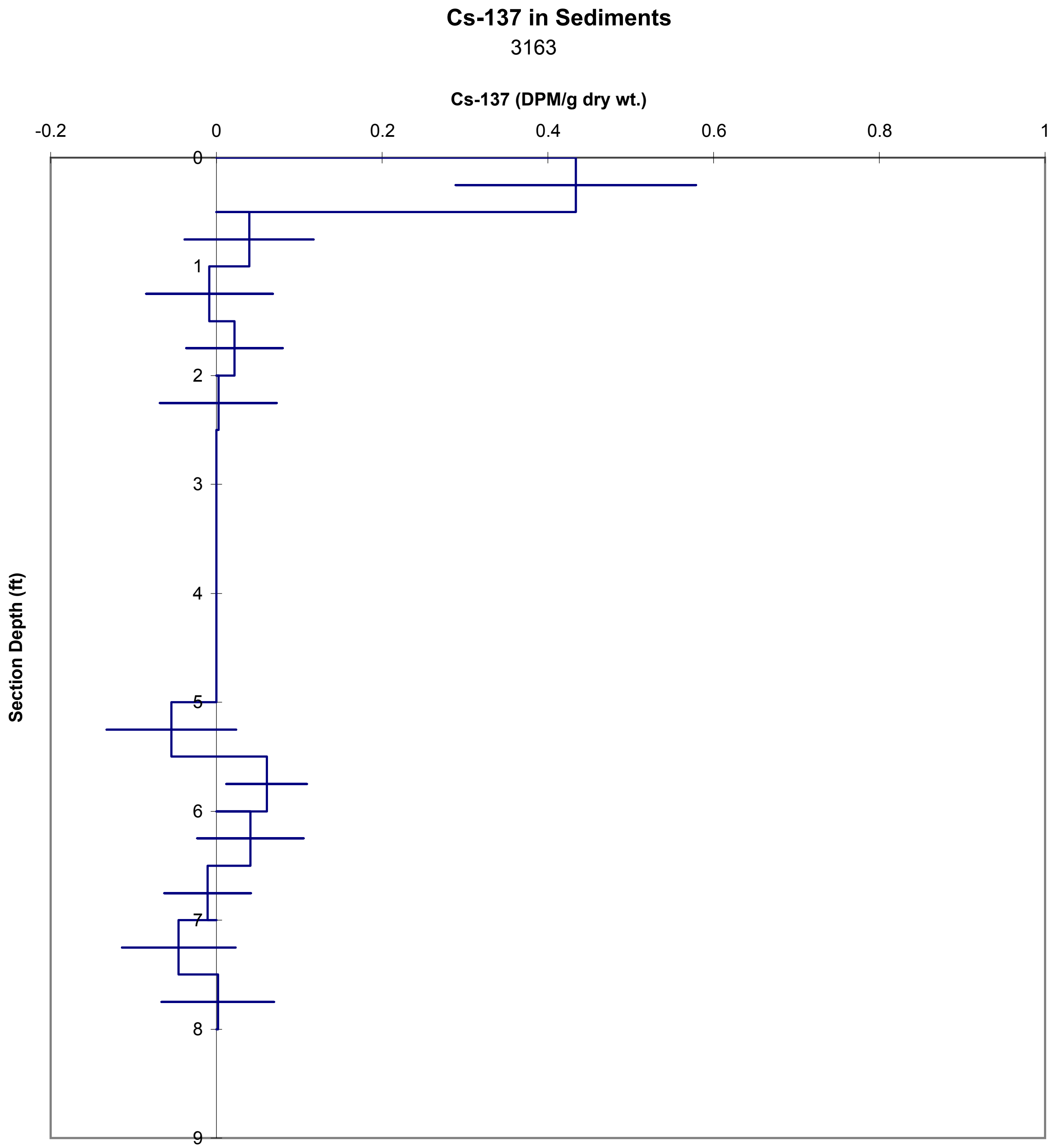


Page 2 of 2

Plot Table X Values	Plot Table Y Values
0	0
0.43379	0
0.43379	0.25
0.57895	0.25
0.28862	0.25
0.43379	0.25
0.43379	0.5
0	0.5
0	0.5
0.03969	0.5
0.03969	0.75
0.1175	0.75
-0.03812	0.75
0.03969	0.75
0.03969	1
0	1
0	1
-0.00838	1
-0.00838	1.25
0.06797	1.25
-0.08472	1.25
-0.00838	1.25
-0.00838	1.5
0	1.5
0	1.5
0.02185	1.5
0.02185	1.75
0.08017	1.75
-0.03647	1.75
0.02185	1.75
0.02185	2
0	2
0	2
0.00256	2
0.00256	2.25
0.07306	2.25
-0.06795	2.25
0.00256	2.25
0.00256	2.5
0	2.5
0	5
-0.05426	5
-0.05426	5.25
0.02371	5.25
-0.13222	5.25
-0.05426	5.25
-0.05426	5.5
0	5.5
0	5.5
0.06085	5.5
0.06085	5.75
0.10951	5.75
0.01219	5.75
0.06085	5.75
0.06085	6
0	6
0	6
0.04129	6
0.04129	6.25
0.10552	6.25
-0.02293	6.25
0.04129	6.25
0.04129	6.5
0	6.5
0	6.5
-0.01062	6.5
-0.01062	6.75
0.04193	6.75
-0.06317	6.75
-0.01062	6.75
-0.01062	7
0	7
0	7
-0.04551	7
-0.04551	7.25
0.02311	7.25
-0.11413	7.25
-0.04551	7.25
-0.04551	7.5
0	7.5
0	7.5
0.00178	7.5
0.00178	7.75
0.06967	7.75
-0.06611	7.75
0.00178	7.75
0.00178	8
0	8

Core 3163

Herb Kelly
CH2M Hill
Gainesville, FL



Data Analysis by Flett Research Ltd.
440 DeSalaberry Ave.
Winnipeg, MB
Canada R2L 0Y7
(204) 667-2505

4/28/2005

Results of Pb-210 Analysis

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7
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E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Delete extra charts AFTER printing!

Client: **CH2M HILL - Herb Kelly**

Transaction ID:

Address: 3011 S.W. Williston Road
Gainesville, FL 32608-3928

PO/Contract No.: 905218

Core ID: 3163

Date(s) Received: Feb. 8, 2005

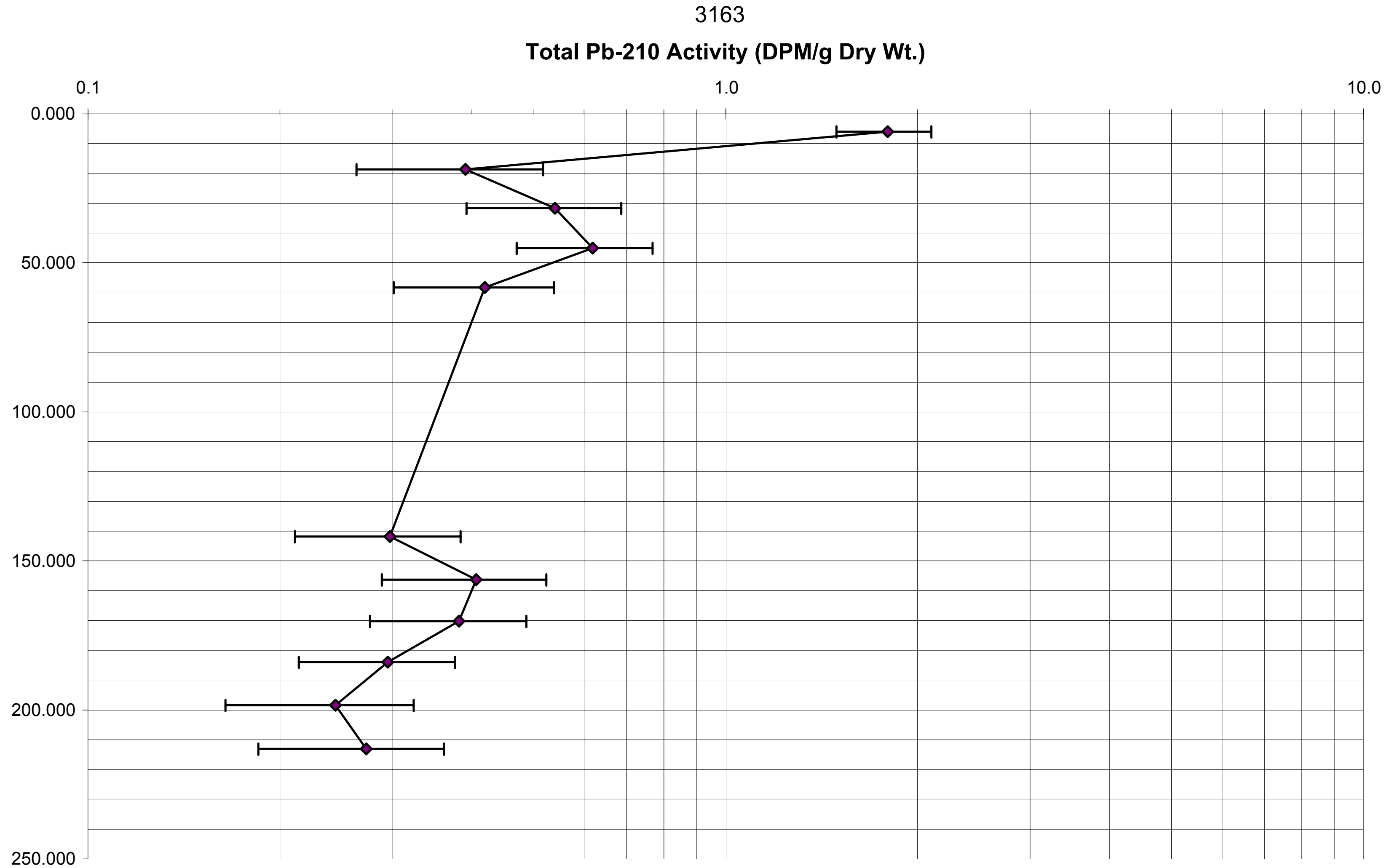
Date(s) Analysed:

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1		121004-SOI-03163-00.5C	127392003	**0.50**	**0.00**	**0.50**	0.00	0.50	0.795	12.110	12.110	6.055	454.455	229.97	1.513	30300	**1.80**	**0.30**	1.41			
2		121004-SOI-03163-01.0C	127392004	**0.50**	**0.50**	**1.00**	0.50	1.00	0.851	12.968	25.078	18.594	392.475	42.99	1.505	30300	**0.39**	**0.13**				
3		121004-SOI-03163-01.5C	127392005	**0.50**	**1.00**	**1.50**	1.00	1.50	0.872	13.284	38.362	31.720	453.475	68.475	1.505	30300	**0.54**	**0.15**				
4		121004-SOI-03163-02.0C	127392006	**0.50**	**1.50**	**2.00**	1.50	2.00	0.865	13.189	51.551	44.956	506.465	89	1.522	30300	**0.62**	**0.15**				
5		121004-SOI-03163-02.5C	127392007	**0.50**	**2.00**	**2.50**	2.00	3.75	0.877	46.758	98.309	58.230	536.99	62.97	1.5	30300	**0.42**	**0.12**				
6		121004-SOI-03163-05.5C	127392008	**0.50**	**5.00**	**5.50**	3.75	5.50	0.952	50.763	149.072	141.820	622.475	54.99	1.598	30300	**0.30**	**0.09**				
7		121004-SOI-03163-06.0C	127392009	**0.50**	**5.50**	**6.00**	5.50	6.00	0.949	14.455	163.527	156.299	498.96	56.495	1.501	30300	**0.41**	**0.12**				
8		121004-SOI-03163-06.5C	127392010	**0.50**	**6.00**	**6.50**	6.00	6.50	0.868	13.231	176.758	170.143	528.99	59.495	1.583	30300	**0.38**	**0.10**				
9		121004-SOI-03163-07.0C	127392011	**0.50**	**6.50**	**7.00**	6.50	7.00	0.940	14.333	191.091	183.925	689.485	57.99	1.535	30300	**0.30**	**0.08**				
10		121004-SOI-03163-07.5C	127392012	**0.50**	**7.00**	**7.50**	7.00	7.50	0.954	14.536	205.627	198.359	616.97	42.475	1.52	30300	**0.24**	**0.08**				
11		121004-SOI-03163-08.0C	127392013	**0.50**	**7.50**	**8.00**	7.50	8.00	0.971	14.799	220.426	213.027	598.97	45.96	1.509	30300	**0.27**	**0.09**				
																		Total Excess DPM in core =			17.02661181	
																Avg. BKG =	**0.39**			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussion

Total Pb-210 Activity vs. Accumulated Sediment



Radionuclide Results for Core 3164

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7

Fax/Phone (204) 667-2505

E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M HILL - Herb Kelly

Address: 3011 S.W. Williston Road, Gainesville, FL 32608-3928
Transaction ID:
PO/Contract No.: 905218
Core ID: 3164
Date(s) Received: Feb 8, 2005
Date(s) Analysed:
Sampling Date(s):
Analyst(s):
Project:

Results authorized by Dr. Robert J. Flett, Chief Scientist

INTERPRETATION

Observations:

The profile of Pb-210 is erratic and essentially vertical in this core and therefore it is impossible to apply the Pb-210 dating technique. The average activity of Pb-210 over the entire length of 0 - 9 ft is fairly low (about 1.20 DPM/g) and could be due solely to the presence of Ra-226 in the sediment.

Regression model of Unsupported Pb-210 activity vs. Cumulative Dry Weight(g/cm2):

CRS model of Age at bottom of Extrapolated section in years vs. Depth of bottom edge of current section in cm:

Conclusion:

Cs-137 is detected only in the top core section, indicating that the bottom edge of the section (at 0.5 ft depth) predates 1954, the year when significant fallout of atmospheric Cs-137 began. Based on this, the sediment accumulation rate is probably less than 0. / (2004 - 1954) = 0.01 ft/yr or 12.895 / 50 = 0.26 g/cm2/yr.

Results of Cs-137 Analysis

Flett Research Ltd.

440 DeSalaberry Ave. Winnipeg, MB R2L 0Y7

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Client: **CH2M HILL - Herb Kelly**

Address: 3011 S.W. Williston Road
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Transaction ID:
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Core ID: 3164
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

Sample ID	Upper Depth (ft)	Lower Depth (ft)	Day sample Counted	Month Sample Counted	Year Sample Counted	Integral NET Cs-137 peak	Counting Error 1 STD (counts)	Count time (seconds)	Dry sample weight (g)	Sample thickness (mm)	CPM/g	Efficiency for Gammas fractional	Gammas per min. per gram	DPM/g	Approx. Error DPM/g	Activity pCi/g	Detector Used
121004-SOI-03164-00.50	0	0.5	24	12	2004	71	10.96	3600	160			0.01742		0.499278	0.1540902		GAMMA17
121004-SOI-03164-01.00	0.5	1	24	12	2004			3600	169					0.0033344	0.0355644		HP
121004-SOI-03164-01.50	1	1.5	23	12	2004			3600	189					0.0195604	0.0354756		GAMMA18
121004-SOI-03164-02.00	1.5	2	23	12	2004			3600	186					-0.021205	0.0461538		HP
121004-SOI-03164-02.50	2	2.5	23	12	2004			3600	144					0.0319902	0.1074036		GAMMA2
121004-SOI-03164-03.00	2.5	3	23	12	2004			3600	119					0.0140704	0.0974358		GAMMA3
121004-SOI-03164-05.50	5	5.5	23	12	2004			3600	173					0	0.1791984		GAMMA12
121004-SOI-03164-06.00	5.5	6	23	12	2004			3600	184					0.0660228	0.0600066		GAMMA6
121004-SOI-03164-06.50	6	6.5	23	12	2004			3600	111					0.018981	0.11988		GAMMA7
121004-SOI-03164-07.00	6.5	7	23	12	2004			3600	135					-0.006893	0.1033632		GAMMA8
121004-SOI-03164-07.50	7	7.5	23	12	2004			3600	142					-0.021649	0.1021644		GAMMA9
121004-SOI-03164-08.00	7.5	8	23	12	2004			3600	135					0.059274	0.0901764		GAMMA10
121004-SOI-03164-08.50	8	8.5	23	12	2004			3600	156					0.051393	0.0806082		GAMMA16
121004-SOI-03164-09.00	8.5	9	23	12	2004			3600	143					-0.043201	0.1100676		GAMMA17

* : See 'Comments' section above for discussion.

Results of Cs-137 Analysis

Flett Research Ltd.
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E-mail: flett@flettresearch.ca Webpage: http://www.flettresearch.ca

Client: CH2M Hill - Herb Kelly

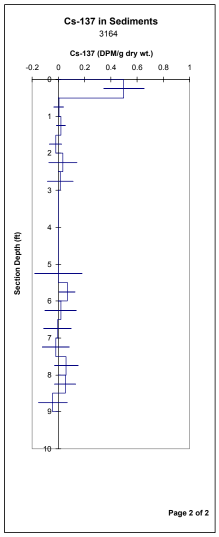
Core ID: 3164
Date(s) Received: Feb. 8, 2005
Sampling Date(s):
Project:

Date(s) Analysed:
Analyst(s):

Results authorized by Dr. Robert J. Flett, Chief Scientist

This table must remain open for chart to plot.

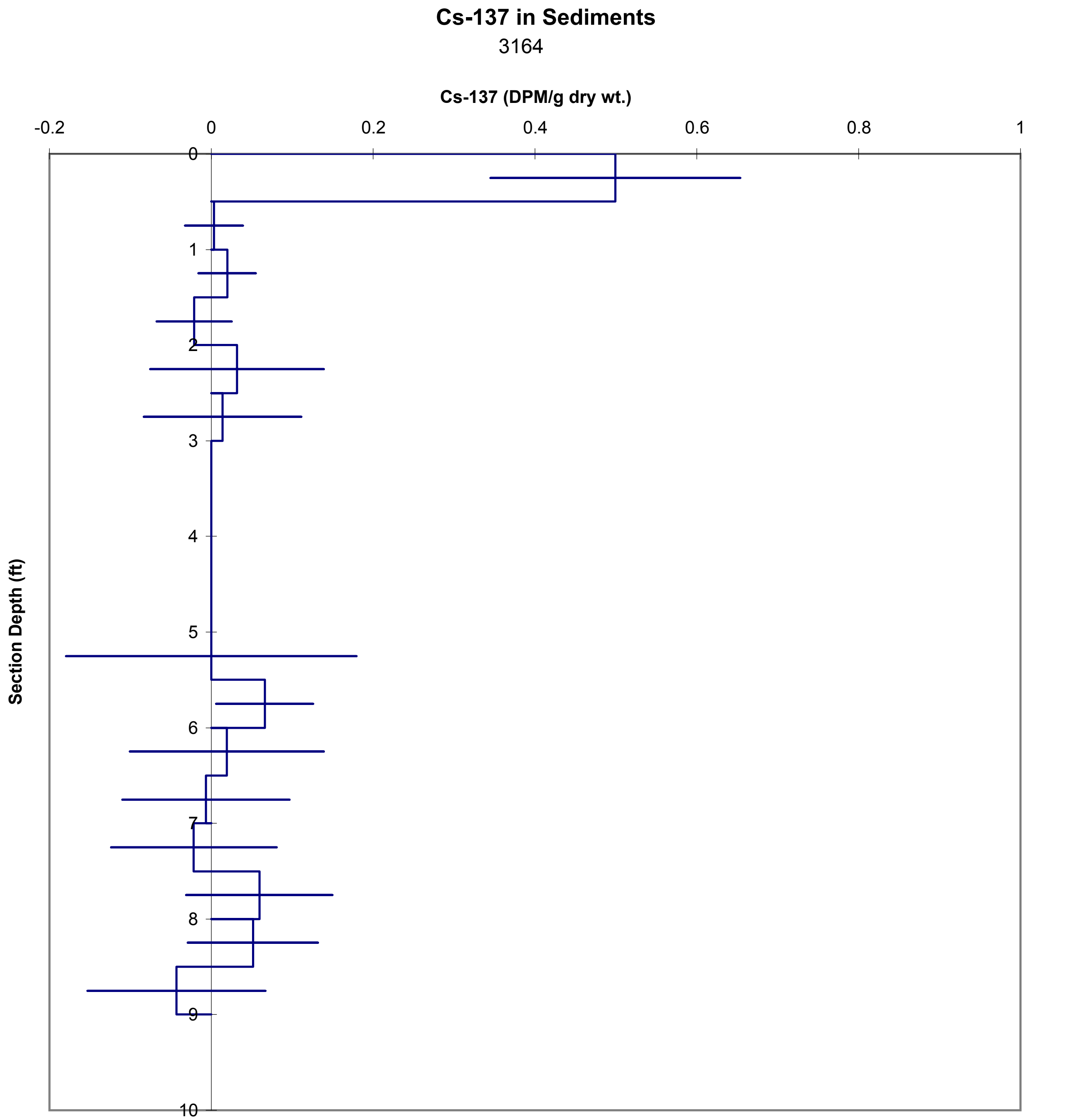
Section No.	Sample ID	Upper depth (ft)	Lower depth (ft)	Cs-137 activity (DPM/g dry wt)	1 Std Dev. Counting Error (DPM/g dry wt.)
1	121004-SOI-03164-00.50	0	0.5	0.50	0.15
2	121004-SOI-03164-01.00	0.5	1	0.00	0.04
3	121004-SOI-03164-01.50	1	1.5	0.02	0.04
4	121004-SOI-03164-02.00	1.5	2	-0.02	0.05
5	121004-SOI-03164-02.50	2	2.5	0.03	0.11
6	121004-SOI-03164-03.00	2.5	3	0.01	0.10
7	121004-SOI-03164-05.50	5	5.5	0.00	0.18
8	121004-SOI-03164-06.00	5.5	6	0.07	0.06
9	121004-SOI-03164-06.50	6	6.5	0.02	0.12
10	121004-SOI-03164-07.00	6.5	7	-0.01	0.10
11	121004-SOI-03164-07.50	7	7.5	-0.02	0.10
12	121004-SOI-03164-08.00	7.5	8	0.06	0.09
13	121004-SOI-03164-08.50	8	8.5	0.05	0.08
14	121004-SOI-03164-09.00	8.5	9	-0.04	0.11



Plot Table X Values	Plot Table Y Values
0	0
0.499278	0
0.499278	0.25
0.653368	0.25
0.345188	0.25
0.499278	0.25
0.499278	0.5
0	0.5
0	0.5
0.003334	0.5
0.003334	0.75
0.038899	0.75
-0.03223	0.75
0.003334	0.75
0.003334	1
0	1
0	1
0.01956	1
0.01956	1.25
0.055036	1.25
-0.01592	1.25
0.01956	1.25
0.01956	1.5
0	1.5
0	1.5
-0.02121	1.5
-0.02121	1.75
0.024948	1.75
-0.06736	1.75
-0.02121	1.75
-0.02121	2
0	2
0	2
0.03199	2
0.03199	2.25
0.139394	2.25
-0.07541	2.25
0.03199	2.25
0.03199	2.5
0	2.5
0	2.5
0.01407	2.5
0.01407	2.75
0.111506	2.75
-0.08337	2.75
0.01407	2.75
0.01407	3
0	3
0	5
0	5
0	5.25
0.179198	5.25
-0.1792	5.25
0	5.25
0	5.5
0	5.5
0	5.5
0.066023	5.5
0.066023	5.75
0.126029	5.75
0.006016	5.75
0.066023	5.75
0.066023	6
0	6
0	6
0.018981	6
0.018981	6.25
0.138861	6.25
-0.1009	6.25
0.018981	6.25
0.018981	6.5
0	6.5
0	6.5
-0.00689	6.5
-0.00689	6.75
0.09647	6.75
-0.11026	6.75
-0.00689	6.75
-0.00689	7
0	7
0	7
-0.02165	7
-0.02165	7.25
0.080515	7.25
-0.12381	7.25
-0.02165	7.25
-0.02165	7.5
0	7.5
0	7.5
0.059274	7.5
0.059274	7.75
0.14945	7.75
-0.0309	7.75
0.059274	7.75
0.059274	8
0	8
0	8
0.051393	8
0.051393	8.25
0.132001	8.25
-0.02922	8.25
0.051393	8.25
0.051393	8.5
0	8.5
0	8.5
-0.0432	8.5
-0.0432	8.75
0.066866	8.75
-0.15327	8.75
-0.0432	8.75
-0.0432	9
0	9

Core 3164

Herb Kelly
CH2M Hill
Gainesville, FL



Data Analysis by Flett Research Ltd.
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4/28/2005

Results of Pb-210 Analysis

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Client: **CH2M HILL - Herb Kelly** **Transaction ID:**

Address: 3011 S.W. Williston Road
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PO/Contract No.: 905218

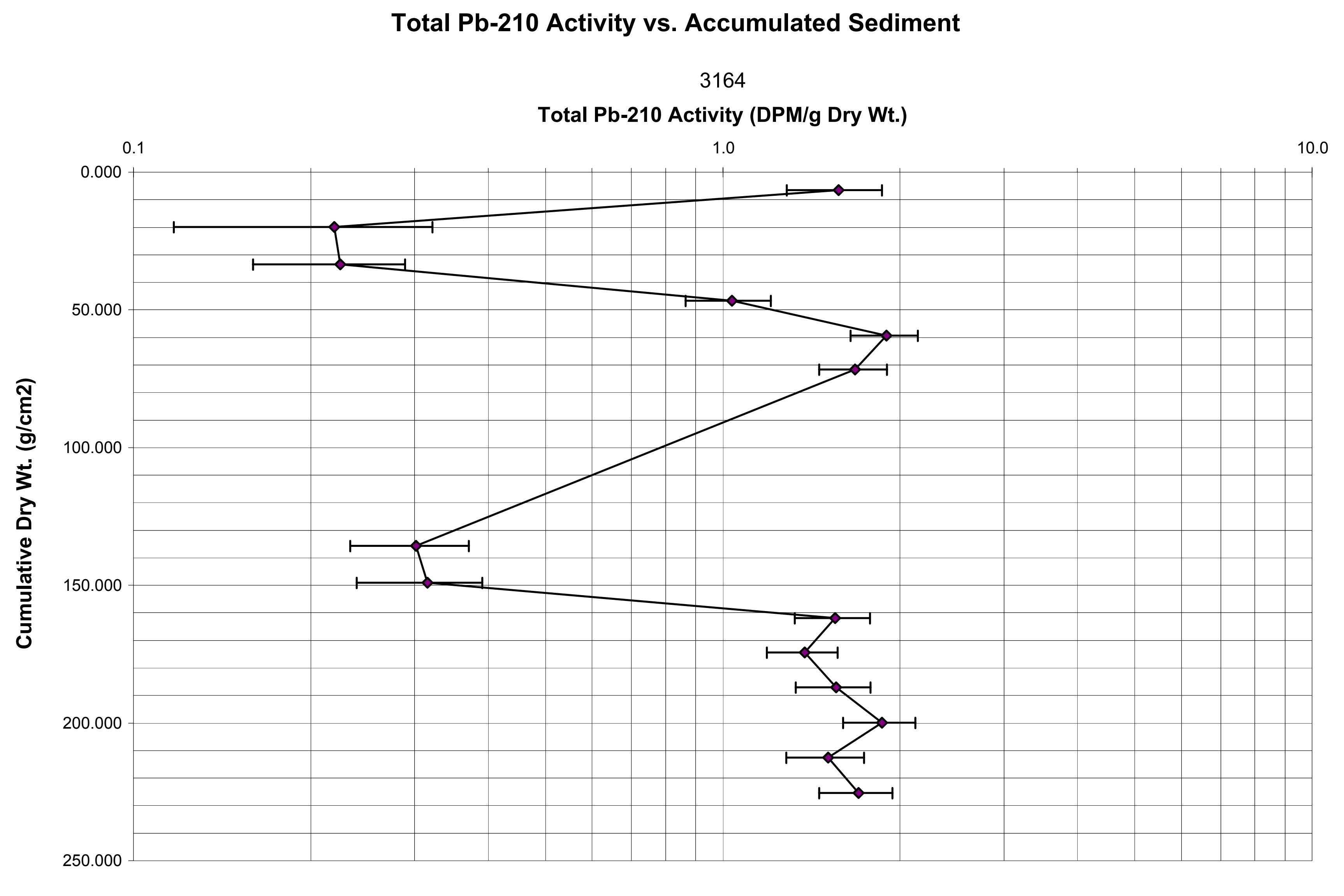
Core ID: 3164

Date(s) Received: Feb. 8, 2005 **Date(s) Analysed:**

Results authorized by Dr. Robert J. Flett, Chief Scientist

Section Number		Sample ID	Sample ID	Section Thickness (ft)	Upper Depth (ft)	Lower Depth (ft)	Extrap-olated Upper Section Depth (cm)	Extrap-olated Lower Section Depth (cm)	Dry Wt./ Wet cc. (g/cm^3)	Mass in extrap-olated section (g/cm^2)	Cumul-ative Mass to Bottom of Current Section (g/cm^2)	Plot-point of cumul-ative mass in current section (g/cm^2)	Po-209 counts less detector back-ground	Po-210 counts less detector back-ground	Weight of Sample Counted (g)	Count Time (sec)	Po-210 Total Activity (DPM/g)	Error Po-210 +/- 1 S.D. (DPM/g)	Po-210 Unsup-ported Activity (DPM/g)	Age at Bottom of Extrapolated Section in Years (CRS Model Estimate)	Depth of bottom edge of current section (cm)	CRS Sediment Accumu-lation Rate ($g/cm^2/yr$)
1		121004-SOI-03164-00.5C	127392019	**0.50**	**0.00**	**0.50**	0.00	0.50	0.846	12.895	12.895	6.447	475.496	205.98	1.5	30300	**1.57**	**0.29**				
2		121004-SOI-03164-01.0C	127392020	**0.50**	**0.50**	**1.00**	0.50	1.00	0.916	13.966	26.861	19.878	374.485	23.465	1.557	30300	**0.22**	**0.10**				
3		121004-SOI-03164-01.5C	127395003	**0.50**	**1.00**	**1.50**	1.00	1.50	0.871	13.274	40.135	33.498	992	62	1.504	60000	**0.22**	**0.06**				
4		121004-SOI-03164-02.0C	127395004	**0.50**	**1.50**	**2.00**	1.50	2.00	0.857	13.067	53.202	46.668	732	214	1.524	60000	**1.04**	**0.17**				
5		121004-SOI-03164-02.5C	127395005	**0.50**	**2.00**	**2.50**	2.00	2.50	0.801	12.211	65.413	59.307	790	418	1.508	60000	**1.90**	**0.25**				
6		121004-SOI-03164-03.0C	127395006	**0.50**	**2.50**	**3.00**	2.50	4.00	0.813	37.183	102.595	71.610	843	398	1.521	60000	**1.68**	**0.22**				
7		121004-SOI-03164-05.5C	127395007	**0.50**	**5.00**	**5.50**	4.00	5.50	0.870	39.790	142.385	135.754	1170	100	1.527	60000	**0.30**	**0.07**				
8		121004-SOI-03164-06.0C	127395008	**0.50**	**5.50**	**6.00**	5.50	6.00	0.866	13.192	155.578	148.982	974	87	1.534	60000	**0.32**	**0.08**				
9		121004-SOI-03164-06.5C	127395009	**0.50**	**6.00**	**6.50**	6.00	6.50	0.821	12.517	168.095	161.836	720	311	1.504	60000	**1.55**	**0.23**				
10		121004-SOI-03164-07.0C	127395010	**0.50**	**6.50**	**7.00**	6.50	7.00	0.825	12.567	180.662	174.378	898	344	1.504	60000	**1.38**	**0.19**				
11		121004-SOI-03164-07.5C	127395011	**0.50**	**7.00**	**7.50**	7.00	7.50	0.838	12.764	193.426	187.044	699	303	1.505	60000	**1.56**	**0.23**				
		121004-SOI-03164-08.0C	127395012	**0.50**	**7.50**	**8.00**	7.50	8.00	0.839259	12.790	206.216	199.821	856	445	1.51	60000	**1.86**	**0.26**				
		121004-SOI-03164-08.5C	127395013	**0.50**	**8.00**	**8.50**	8.00	8.50	0.839865	12.800	219.016	212.616	821	347	1.514	60000	**1.51**	**0.23**				
		121004-SOI-03164-09.0C	127395014	**0.50**	**8.50**	**9.00**	8.50	9.00	0.841249	12.821	231.836	225.426	879	415	1.501	60000	**1.70**	**0.24**				
																		Total Excess DPM in core =			0	
																Avg. BKG =	**1.20**			Avg. Sed. Rate =		#DIV/0!

*: See 'Comments' section on 'Interpretation' sheet for discussion


Total Pb-210 Activity vs. Accumulated Sediment
3164
Total Pb-210 Activity (DPM/g Dry Wt.)
0.1
1.0
10.0
0.000
50.000
100.000
150.000
200.000
250.000
Cumulative Dry Wt. (g/cm2)